3.2 Physical Environment

3.2.1 Watershed - Soils, Water Quality and Hydrology

3.2.1.1 Background

This analysis of the current and predicted watershed resource condition is focused on the potential effects to soil quality, beneficial uses of water, and hydrologic function of streams and riparian areas. Conditions are analyzed for compliance with the Sierra LRMP as amended by the 2004 SNFPA. Compliance with these documents includes compliance with Riparian Conservation Objectives (RCOs) (USDA Forest Service, 2004) and Best Management Practices (BMPs) (USDA Forest Service, 2000). These findings are documented in the Riparian Conservation Objective Consistency Analysis Report and the Hydrology Specialist Report, in the project file. The alternatives are also assessed for compliance with applicable water quality goals identified in the Water Quality Control Plan for the Sacramento and San Joaquin River Basins, 4th edition (CVRWQCB, 2004a) and the Water Quality Control Plan for the Tulare Lake Basin, 2nd edition (CVRWQCB, 2004b). These documents are referred to as Basin Control Plans.

This section presents general information about the watershed resources being analyzed and the types of impacts that could result from the uses being analyzed, consisting of descriptions of the relevant physical processes and a review of pertinent literature. The analysis focuses on impacts in the areas of soils, hydrology, and water quality. These are presented below.

Soils - Soils perform important functions, including absorbing precipitation, providing physical support and nutrients to plants, and rendering potentially toxic pathogens harmless (Daily et al., 1997). Healthy soils also slow water runoff to gradually provide water to lakes and streams. Activities related to the action alternatives that may affect soils include pack animal use of system and use trails, campsites, and grazing areas, and cross country travel. The types of effects that may occur are soil compaction, displacement, and erosion.

Soil is compacted when pressure on the ground surface causes it to be packed down, which is a possible effect of trampling by animals and humans. This results in reduction of the pore spaces between the soil particles. The pore spaces are the areas available for water to infiltrate into the soil, and when the pore space is reduced, the pathway for water to enter the soil and the volume of water that can be stored in the soil are both reduced. In addition, plant roots cannot penetrate compacted soils as easily. The degree or severity of compaction that occurs in a given area is a function of the soil type (some soils are more prone to compaction than others) soil moisture (in general, moist soils are more susceptible to compaction than dry soils), and the intensity of trampling. Trampling around campsites, trails, and meadows can cause damage to soils through compaction. McClaran (2000) notes several studies that found that the initial trampling of soil causes more impact than continued trampling.

Soil is displaced when it is physically moved out of its location. Erosion is a type of displacement. Another mechanism of displacement is the direct movement of soil that occurs on trails, campsites, and in grazed meadows due to travel by recreational users and pack stock. Deluca et al (1998) looked at the effects of hikers, llamas and horses on wet and dry trails at two different use intensity levels in Montana. They found that simulated rainfall on the trails that were dry during use yielded more sediment than the trails that were wet during use, and concluded that soil on the dry trails was more prone to detachment and displacement which made it available for transport. The soil type was the same on the wet and dry segments, so this conclusion is most likely to apply to trails in the project area that are moist in early season and later become dry. Trail segments in the project area that stay wet are likely to have different soil types (i.e., meadow soils). In this analysis, references to soil displacement will focus on the impacts that detach soil and make it available for erosion.

Erosion occurs when soil is moved off of an area by water or wind. Erosion is a natural process, and is especially prominent in the high elevation portions of the project area where coarse grained, organic poor soils occur on steep slopes. But erosion processes are accelerated by soil disturbance caused by human use of the land. For example, ground cover protects soil from erosion, but ground cover is often removed from campsites, stock holding areas and trails. Raindrop impact on bare soil dislodges soil particles and encourages sheet and rill erosion, while compacted soils limit infiltration and generate increased runoff which in turn produces more erosion. These processes work together and can cause erosion at much higher rates than natural background levels. Another way that erosion rates can be increased is through the displacement of soils on trails. The soils are loosened by traffic on the trail and are then susceptible to erosion by water which can transport it to another area, or by wind which can blow the powdered soil. Some of this eroded material is delivered to streams, where it has indirect effects on water quality and aquatic habitat.

There is generally higher erosion on trails that are used by livestock than on trails used by hikers alone. Leung and Marion (2000) describe a study that found that trails with a high proportion of horse use in the Great Smoky Mountains NP tended to be wider and muddier, with more areas of multiple trails. Deluca et al (1998) found that erosion from llamas was slightly higher but not statistically different than the erosion resulting from hikers, but the erosion resulting from horses was about twice that caused by hikers. In addition, they found that increasing use fourfold from 250 passes to 1000 passes only increased sediment yield by a factor of 1.4. In other words, more sediment was generated by the initial traffic than by the addition of more traffic.

Marion (1998) states that trail location and maintenance can have more influence on trail erosion than type and amount of use. IDT field assessments of trails in the project area yielded the conclusion that trail maintenance and reconstruction needs play a strong role in soil erosion problems and water quality concerns related to those trails (Hopson 2004a, 2004b, 2004c, 2004d).

For this analysis, though data for the amount of commercial pack stock use is known, information on the number of privately owned pack animals used on trails is lacking. Even in Kaiser (KAI) and Dinkey Lakes (COO, DIL, HEL, NEL) Wilderness Areas where overnight use is tracked on permits, day use data is not collected. This means that the total number of animals and the proportion of commercial versus private stock are unknown. For the same reason, the total number of hikers is also unknown. The curvilinear relationship between trampling and impacts described above further complicates the task of quantitatively estimating the impact of each of these groups. For these reasons, a quantitative comparison of the effects of permitted stock compared to other users is not presented. The discussion of the effects of permitted stock on trail erosion, campsite impacts, and grazing areas will be qualitative.

Hydrology and Water Quality – The majority of the analysis area is located in the Upper San Joaquin River Basin. The northern portion of the analysis area (NED and a small portion of CLO AUs) flow into the Merced River, which ultimately flows into the San Joaquin River. A portion of NED lies in the Upper Chowchilla-Upper Fresno system. All of these areas are covered by the Water Quality Control Plan for the Sacramento and San Joaquin River Basins (CVRWQCB 2004a). The southern portion of the analysis area (HEL, NEL, DIL, DFC, WIS and TUL) flows into the Upper Kings River, and is covered by the Water Quality Control Plan for the Tulare Lake Basin (CVRWQCB 2004b).

Water quality and hydrology are important ecosystem elements. The State of California recognizes various needs that water bodies serve by designating 'beneficial uses'. Table 3.29 displays the beneficial uses designated by the State in the project area (CVRWQCB, 2004a and 2004b). The beneficial uses are described in Table 3.30.

Table 3.29: Beneficial uses of waters in each AU.

Basin Plan	AUs	MUN	AGR	POW	REC-1	REC-2	WARM	COLD	WILD	RARE	SPWN	FRSH
Sacramento and San Joaquin River Basins	NED, CLO, EDI, CHO, FLO, KAI, HNE, HNW, COO, HEL*	X	X	X	X	X	X	X	X			
Tulare Lake Basin	HEL*, DIL, NEL, DFC, TUL, WIS			X	X	X	X	X	X	X	X	X

* The majority of the HEL AU is in the Kings River Basin. A small portion at the northern edge is in the San Joaquin Basin.

Table 3.30: Descriptions of beneficial uses in the project area

Beneficial Use	Description
MUN	Municipal and Domestic Supply
AGR	Agricultural Supply
POW	Hydropower Generation
REC-1	Water Contact Recreation
REC-2	Non-Contact Water Recreation
WARM	Warm Freshwater Habitat
COLD	Cold Freshwater Habitat
WILD	Wildlife Habitat
RARE	Rare, Threatened, or Endangered Species
SPWN	Spawning, Reproduction, and/or Early Development (cold water fisheries only)
FRSH	Freshwater Replenishment

The Basin Control Plans establish surface water quality objectives for 19 parameters (CVRWQCB 2004a, 2004b). The parameters that are discussed in this analysis are Bacteria and Sediment. Other parameters are either not likely to be affected by the activities being analyzed (for example, Radioactivity, Salinity) or are related to the selected parameters and qualitative effects would be similar (i.e., the type of Floating Material that may result from this project can be represented by the discussion of Bacteria, Turbidity is related to Sediment).

The analysis units contain headwater areas with good water quality. (In general, stream reaches with impaired water quality tend to occur lower in watersheds where land uses, especially rural and urban development and agricultural uses, result in increased sediment, nutrients, and chemical consituents.) Assuming that water quality currently meets or exceeds water quality standards, the water is subject to the Antidegradation Policy, which requires that wherever existing water quality is better than the established objectives, the existing quality will be maintained (CVRWQCB 2004a, 2004b).

The State Water Quality Control Board has accepted the BMP program (USDA 2000) as the method used by the Forest Service to protect water quality. The practices, procedures and program comply with the requirements of the Federal Clean Water Act. They are also within the guidelines of the Water Quality Control Plans (Basin Plans) developed by the CVRWQCB.

The BMPs applicable to pack stations are displayed in Table 3.31.

Table 3.31: BMPs applicable to pack station operations.

Applicable BMP	How to Apply	Applies To Which Pack Stations?
Practice 2-12: Servicing and Refueling of Equipment	Servicing and refueling must occur outside of SMZs. (SMZs range from 25 to 100 feet in width, based on stream classes as defined in FSH 2509.22. Sierra Supplement 1.)	All
Practice 2-28: Surface Erosion Control at Facility Sites	D&F will apply erosion control measures at the Main Pack Station and the Badger Spike Station facilities in HNE. The CPO Dinkey Creek Site will be monitored to determine if there is a need to implement erosion control measures. Through the life of all permits, facility site conditions will be remediated where necessary to reduce the amount of surface erosion and the amount of soil entering streams.	All
Practice 4-4: Control of Sanitation Facilities	Toilet facilities and septic systems must meet all State and local health and water quality requirements. Toilets and septic systems must be located away from surface water and sensitive areas. Pack stations should encourage their clients to follow Leave No Trace principles.	All
Practice 4-5: Control of Solid Waste Disposal	Trash must be removed from all facilities, campsites, trails and grazing areas. Pack stations should encourage their clients to follow Leave No Trace principles.	All
Practice 4-8: Sanitation at Hydrants and Water Faucets within developed recreation sites	No cleaning or washing may occur at water faucets that are not specifically designed for that purpose. Pack stations should educate their clients in Leave No Trace principles.	All
Practice 4-9: Protection of Water Quality Within Developed and Dispersed Recreation Areas	No substance that could degrade water quality (i.e. human waste, petroleum products, sediment) may be placed in or near any stream or other water body. Manure management at facilities must protect water quality. Pack stations should educate their clients in Leave No Trace principles.	All
Practice 4-10: Location of Pack and Riding Stock Facilities and Use Areas in Wilderness, Primitive, and Wilderness Study Areas	The 2001 Wilderness Plan direction states that pack and saddle stock hitching, tethering, or tying is prohibited within 100 feet of lakes and streams, except while loading and unloading. Campsites where stock animals are held must be 100 feet away from lakes and steams, where topography allows, or no closer than 50 feet in any case.	All
Practice 7-3: Protection of Wetlands	CPO will avoid the small, isolated wet meadow located within the Woodchuck Trailhead Spike Station in WIS. Through the life of all permits, facilities and operations may not impact wetlands. Impacts must be avoided or mitigated. Through time, needs for additional wetland protection will be determined by the permit administrator.	All
Practice 7-4: Forest and Hazardous	All SUP holders must develop SPCC Plans for their operations prior to operating on NFS land. This applies	All

Substance Spill Prevention Control and Countermeasure (SPCC) Plan	particularly to the MTR gasoline pumps at Florence Lake Resort.	
Practice 7-5: Control of Activities under Special Use Permit	Permits will contain necessary measures for protecting water quality. Permit administration ensures protection of water quality over time. Includes implementation and monitoring of pack stock grazing standards and guidelines.	All

Application of these BMPs at pack station operating areas, and including these areas in the sample selection pools for annual monitoring of the BMPs, constitutes compliance with the applicable water quality objectives.

Pack stock use can cause a variety of direct and indirect impacts to water quality and hydrology, including increased erosion and sedimentation, and contamination due to animal waste (McClaran and Cole, 1993).

Concentrated pack stock use, such as grazing in meadows, hitch lines in upland areas, loading areas and corrals may cause erosion and potentially water quality impairment. As described previously, the combination of decreased soil cover and increased soil compaction leads to increased erosion. The eroded material may be transported into streams, lakes, or other sensitive aquatic habitats. Unless the concentrated runoff is strong enough to create large rills or gullies, the process usually does not continue beyond the area of compacted and unprotected soils – in other words, vegetated buffers are effective at preventing this material from entering surface water and sensitive habitats. Hook (2003) found that 6 m (20 foot) wide buffers retained 94-99% of sediment entering them regardless of their slope, vegetation type, or stubble height, but notes that dense vegetation provides the lowest risk of sediment delivery to streams. McClaran (2000) states that intensity and season of use are the most strongly related to the intensity of meadow impacts, and recommends that pack stock grazing be avoided in wet areas with a short growing season.

Pack stock create similar impacts at campsites. A study in a Montana wilderness area by Spildie et al (2000) suggests that camping with pack stock creates about twice as much disturbance as camping without stock, measured in terms of bare area and impacts to vegetation such as exposed tree roots. Their study also showed that designating stock campsites resulted in a reduction in the size of the campsites that were no longer used by stock as a result of resource recovery at these sites.

The Trails section (section 3.1.3) provides a thorough explanation of erosion on trails and the potential for contribution to surface water. The risk of contribution to surface water is related to the number of stream crossings. Based on Forest GIS layers of the analysis area, the number of stream crossings tends to be higher on trails that follow drainage bottoms and is more variable on side slope and ridge top trails. More of the streams crossed are likely to be perennial on the drainage bottom trails than the upper position trails, where most of the streams flow seasonally. The total number varies from about 3 to 8 crossings per mile. The slope of the trail as it approaches the crossing is also an

important factor. Although these factors are relevant to the amount of sediment generated by a given trail segment, they are not discussed further because none of the alternatives propose to change them. The distinction between the alternatives can be adequately framed in terms of a relative difference in sediment generated on individual trail segments.

The issue of waterborne pathogens in the analysis area, particularly in the wilderness areas, was raised in public comment. Animal manure on trails, in meadows, and in streams is a source of fecal pathogens, and is identified by McClaran and Cole (1993) as one of the most likely impacts of pack stock use.

Giardia lamblia came to the attention of outdoor recreationists in the 1970s, when an outbreak in a group of campers in Utah was reported (Welch 2004). Since that time, investigations of water quality in recreation areas have found a correlation between increasing recreational use and increasing concentrations of pathogens. For example, in Sierra Nevada wilderness areas, Suk and others (1987) found *Giardia lamblia* cysts in 45% of sampled streams downstream from high recreational use areas, and in only 17% of samples from areas of low recreational use. Even in areas of high use, cyst concentrations were so low that a sample size of 378 liters (100 gallons) was required to achieve detections. A study of *Giardia* in Backpacker magazine, as cited by Welch (2004), found a maximum concentration of 1.5 cysts per liter, which is low compared to the 'infective dose' of 10 cysts which would be likely to cause human illness. In other words, in the area where *Giardia* concentrations were highest in the Backpacker magazine study, a person would probably need to drink 6.5 liters of contaminated water in order to ingest enough cysts to cause illness.

More recent work (discussed below) suggests that bacterial contamination poses a greater health risk than Giardia. Fecal coliform is a common indicator of pathogenic bacteria. Reported as the number of colony forming units per 100ml of water, it is the CVRWQB indicator for bacterial contamination. Several recent studies have examined the occurrence of fecal coliform in surface water in the Sierra Nevada. These studies have also attempted to identify the sources of the fecal coliform levels found. The results of these studies will be discussed in terms of the CVRWQCB water quality objective for Bacteria:

> In waters designated REC-1, the fecal coliform concentration based on a minimum of not less than 5 samples for any 30-day period shall not exceed a geometric mean of **200/100ml**, nor shall more than ten percent of the total number of samples taken during any 30-day period exceed **400/100ml**.

Derlet and Carlson (2004) found 9 of 67 (13%, excluding 1 sample taken from a faucet) surface water samples from various sampling locations in National Parks in the Sierra Nevada contained at least 200/100ml coliform. (The highest concentration found was 2000/100ml, which came from the faucet at a campground.) To explore whether concentrations accumulate over the course of the season of use, twelve sites were

sampled in 'early' (May-July) season and again in 'late' (August-September) season. At these sites, one sample contained 200/100ml in early season and 100/100ml in late season, and one late season concentration exceeded 400/100ml (this site had no detection in the early season). There was no apparent trend in concentrations based on these twelve sites. Although sample sites were stratified into risk groups based on the type of recreation use, the authors were unable to determine the source of the coliform at these sites.

In a similar study, Derlet et al (2004) examined water quality in National Forest wilderness areas and found that 22% of samples contained at least 200/100ml, and 5% exceeded 400/100ml. The highest concentration found was 550/100ml. The sample sites were stratified into risk groups described as high use by backpackers, high use by pack animals, livestock grazing allotments, and sites uncontaminated by humans or domestic animals. Although the paper does not identify which of these risk groups each sample location represents, the authors conclude that the highest levels of coliforms were found in areas heavily used by humans, livestock, or cattle.

The most recent work by Derlet and Carlson (2006) applies a similar approach, and this paper does identify the risk group for each sample. Fifteen samples were collected to represent each risk group, for a total of 60 samples. In the areas characterized as high use by backpackers, 1 sample (7%) had 200/100ml. At sites with heavy pack stock use, 11 samples (73%) were at least 200/100ml, and 3 (20%) exceeded 400/100ml. Cattle grazing sites had 9 samples (60%) at least 200/100ml, and 2 (13%) exceeded 400/100ml. The authors state surprise at finding the high incidence of fecal coliform in areas used by pack animals, and note that their previous studies looked at '…water taken primarily from watersheds polluted by both pack animals and humans…'. They say that this study '…would suggest that pack animals are most likely the source of coliform pollution.'

It is difficult to compare these reported fecal coliform values, based on single samples, to the water quality standards, which require at least 5 samples within a 30-day period. Concentrations of bacteria fluctuate rapidly in surface water, and individual samples represent only the time of sampling (Bohn and Buckhouse 1985). This is why the CVRWQCB water quality objective requires that at least 5 samples per month are used to characterize a given sample location. The reported values can be interpreted as an indicator of how each site might compare to the numeric objective, but the variability cannot be predicted from a single sample.

In an editorial published with Derlet and Carlson (2004) and Derlet et al (2004), Welch (2004) states "no studies suggest that North American wilderness waters are a source of bacterial enteritis". He asserts that hand-to-mouth transmission of disease is a more common cause of illness in the backcountry than waterborne pathogens. Treatment of drinking water by filtration or chemical additives is recommended for all backcountry users. Filtration is effective for bacteria, but smaller viruses require chemical treatment.

In a synopsis of existing information on livestock management in wilderness, McClaran (2000) notes that studies have found that contamination is greatest with direct deposit of

feces into surface waters, which equates to about 5% of the total manure produced by a free-roaming animal. For this analysis, the animals are considered to be 'free roaming' in grazing areas only. On trails, the number of stream crossings determines the risk of feces being deposited directly into streams. McClaran (2000) also notes that the proportion of animal use near streams in meadows is more closely related to the amount of contamination than the total number of animals in the meadow, that contamination is concentrated within 1 meter of feces, that fecal coliform concentrations in cattle feces that are 30 days old are several orders of magnitude lower (although still 'high') than at one or two days, and that drying strongly decreases the risk of contamination so that drier horse and sheep feces present a lower risk than cattle feces.

Based on the known variability of fecal coliform in surface waters, the entirety of current information reported as single samples only which are not comparable to the CVRWQCB objectives, the inconclusive picture drawn by the existing literature, the lack of information regarding the proportion of commercial pack animal use to private pack stock and cattle (where the project area overlaps grazing allotments), and the lack of evidence correlating pathogens in backcountry water with human disease, the effects of the alternatives on pathogenic water quality will be discussed in general and qualitative terms.

Alteration of hydrologic processes is not a common effect associated with commercial pack stock activities. In some areas, local hydrology is altered by current trail conditions. For example, entrenched trails may capture a stream or local runoff and change the timing and location of flow patterns. Pack animal use on these trails would contribute to these conditions, which could worsen or could become more widespread by occurring on additional trail segments. However, this condition will not improve without active remediation – trail reconstruction. Without trail reconstruction, the impacts will continue under any alternative.

Some of the pack stations are permitted to store or use hazardous materials such as gasoline, diesel, and propane for vehicles, pumps and generators. The special use permit requires that these materials are used and stored according to federal, state and local ordinances, and BMPs.

3.2.1.2 Methodology

This analysis uses methods that are consistent with the Record of Decision (ROD) for the 2005 Pack Stock Management EIS (the 2005 ROD) to identify and describe potential soils, water quality, and hydrology impacts. The 2005 ROD identifies site-specific standards and guidelines for commercial pack stock management within the Ansel Adams and John Muir wildernesses. The environmental consequences of commercial pack stock under these standards and guidelines were analyzed and documented in the 2005 Pack Stock Management EIS. Decisions made in the 2005 ROD would be incorporated into this FEIS under either action alternative.

Analysis elements were selected to represent the soil, water quality, and hydrology parameters that could potentially be affected by commercial pack stock operations and

that tie to Desired Conditions and Standards and Guidelines in the LRMP. Field assessments were conducted by the ID Team or independently by the hydrologist to gather information about these analysis elements under existing conditions, and to identify areas of concern. This information was used to specify design measures for the project that mitigate known problems and reduce impacts. Because quantitative data is lacking in most cases, field observations, BMP evaluations, rapid assessments and literature review were used to predict the effects of the alternatives.

The Forest Service Soil Management Handbook (2509.18) establishes soil quality standards to prevent long term losses to site productivity and hydrologic function. The primary objective of this handbook is to 'maintain or improve the inherent long-term soil productivity.' Types of disturbances that could affect soil productivity are categorized as compaction, displacement, erosion, puddling, loss of protective cover, and severe burning. Soil quality standards are applied to activity areas. The R5 Supplement to the Soil Management Handbook definition of an activity area is:

> Activity Area. The area of land dedicated to growing vegetation to which soil quality standards for soil productivity are applied is known as the activity area. It is that area within a management area where soil disturbing activities take place and is of practical size for management, sampling, and evaluation. Activity areas include timber harvest units within a sale area, burn areas within a prescribed burn, and grazing areas within an allotment. System roads and trails and other areas not dedicated to growing vegetation are not included as part of activity areas.

For this analysis, the grazing areas are the considered activity areas. Trails, campsites, and pack station facilities are considered to be dedicated to uses other than growing vegetation, but impacts to these areas are discussed because compaction and erosion there can result in increased overland flow and sedimentation to water bodies.

Desired Conditions

Eleven Desired Condition (DC) statements were developed in the SNFPA (USDA Forest Service 2004) for Riparian Conservation Areas (RCAs)[1]. The following DC statements apply to soil and water resources in this project (those pertaining specifically to habitat requirements or vegetation resources are not listed here). The analysis elements (presented in the next section) that tie to these DC statements are indicated in brackets after each statement.

- Water quality meets the goals of the Clean Water Act and Safe Drinking Water Act; it is fishable, swimmable, and suitable for drinking after normal treatment. [Water Quality, RCOs]

[1] RCAs are defined as the areas extending 300 feet on either side of perennial streams or special aquatic features including springs, meadows and fens, and 150 on either side of seasonally flowing streams. For more information, refer to USDA Forest Service 2004, or the RCO Consistency Analysis Report in the project record.

- The connections of floodplains, channels, and water tables distribute flood flows and sustain diverse habitats. [Hydrology and Geomorphology]
- Soils with favorable infiltration characteristics and diverse vegetative cover absorb and filter precipitation and sustain favorable conditions of stream flows. [Soil Quality, RCOs]
- The physical structure and condition of streambanks and shorelines minimizes erosion and sustains desired habitat diversity. [Hydrology and Geomorphology, RCOs]
- Meadows are hydrologically functional. Sites of accelerated erosion such as gullies and headcuts are stabilized or recovering. Vegetation roots occur throughout the available soil profile. Meadows with perennial and intermittent streams have the following characteristics: (1) stream energy from high flows is dissipated, reducing erosion and improving water quality; (2) streams filter sediment and capture bedload, aiding floodplain development; (3) meadow conditions enhance floodwater retention and groundwater recharge; and (4) root masses stabilize streambanks against cutting erosion. [Hydrology and Geomorphology, RCOs]

Analysis Elements

The analysis elements used for these resources are:

- Soil Quality – disturbed area (soil is compacted, displaced, eroded, fragmented, or protective cover is removed)
  - Evidence of disturbed soil in grazing areas
- Water Quality – sediment and bacteria (fecal coliform)
  - Implementation and effectiveness of BMPs
  - Observed evidence of eroded soil entering water, and manure in or adjacent to streams
- Hydrology and geomorphology – meadow and stream function and condition
  - Proper Functioning Condition (PFC) assessments
  - Observed stream sinuosity, stream bank shape, stream incision, and hydrologic alteration in meadows
- Riparian Conservation Objectives (RCOs)
  - Soil Quality, Water Quality, and Hydrology and Geomorphology elements are considered to determine whether RCOs in the 2004 SNFPA ROD (USDA 2004) are met.
- Cumulative Watershed Effects (CWEs) - impacts to beneficial uses that occur downstream of direct and indirect impacts and are transmitted and accumulated in the stream system
  - Equivalent Roaded Acres (ERA) model is used as an indicator outside of wilderness
  - An index of disturbance similar to ERAs but developed specifically for wilderness is used within the wilderness
  - The other analysis elements listed above are used to consider and describe potential cumulative effects.

Field Assessments

The District Hydrologist participated in IDT field assessments and completed a report for each pack station to document field conditions, identify potential issues related to watershed resources, and to help develop resource protection measures for the proposed action. The field assessments addressed campsites, trails, grazing, and pack station facilities. There may be other types of impacts associated with the commercial pack station uses, however, the Hydrologist determined that this focus would capture the most likely areas where soils and water quality/watershed values might be impaired or in violation of applicable management direction. A copy of these field reports (Hopson 2004a, 2004b, 2004c, 2004d, 2004e) and data sheets can be found in the project record. The information gathered in field assessments is summarized in Tables 3.33, 3.34, 3.36, and 3.37, and is discussed in the individual AU sections.

Facility evaluations: Pack station facilities were reviewed in the field. The sites were assessed relative to management direction and applicable laws and regulations for soils, water quality, and watershed. Photographs and field notes documented environmental conditions. BMPs are considered 'implemented' if standard protection measures for water quality are met. A 'minor departure' indicates that implementation can be improved. A 'major departure' indicates that one or more standard practices were not implemented. This information was used for the water quality analysis element.

The Sierra NF coordinated with the Regional Water Board during the development of this EIS. Regional Board staff participated in field evaluations of some pack station facilities and in follow-up discussions with the hydrologist.

Campsite evaluations: Campsite evaluations were conducted using BMP evaluation program methods (USDA Forest Service 2002), and are used for the water quality analysis element. BMP evaluations include implementation and effectiveness monitoring, which describe campsite conditions relative to potential water quality effects. The 2001 Wilderness Plan states that campsites should be located at least 100 feet from water, and in cases where terrain does not permit, no closer than 50 feet from water. In wilderness areas (KAI, COO, DIL, HEL, NEL), BMPs were considered "implemented" if campsite location met Wilderness plan standards, and "effective" if no evidence of water quality degrading substances (e.g., sediment, livestock manure, or other substances originating from campsites) was found reaching an adjacent water body. A 'minor departure' in implementation indicates that the site is between 50 and 100 feet from water, and could be better situated. The campsites assessed in NED are outside of wilderness areas and have no LRMP or other management direction regarding their distance from water. However, in order to determine BMP implementation, the wilderness direction described above was used. It is possible for BMPs to be implemented at a site but not effective (e.g., the site meets direction for distance from water, but there is still evidence of eroded material reaching surface water).

The campsite evaluations do not necessarily reflect on the pack station operations. These assessments were intended to provide a general picture of how well BMPs were being

implemented in the wilderness areas and if they were effective in protecting water quality. Campsites encountered during IDT field trips were selected for evaluation in the field by the hydrologist and were non-random selections. Therefore, they do not represent a larger population of campsites or conditions outside of the surveyed sites. Most evaluations did not determine whether commercial pack stations or their clients used the site, or whether most or all the use was from private stock and/or backpackers.

Trail evaluations: A trail assessment protocol was used to document resource conditions associated with both system and use trails. Trail segments were rated on a scale of 0 – 5, with 0 representing a very stable trail with no repair or maintenance needed and 5 representing a severely degraded trail with substantial maintenance or reconstruction needs. Unstable or degraded trails experience more erosion and contribute more sediment to streams. Trail evaluations are used for the water quality (sedimentation) analysis element. See Trails section for further details.

Grazing area / meadow evaluations: Grazing assessments consisted of a two-tier process completed by the IDT in meadows. Twenty of the 24 meadows known to have been grazed by commercial pack stock or proposed by the pack station operators for grazing were assessed in the field. After field surveys were completed, the team assessed grazing suitability using physical and biological criteria. A qualitative worksheet called a grazing suitability checklist was used to document potential grazing issues using physical and biological criteria. The second tier was a worksheet where physical and biological characteristics were given a rating to describe meadow characteristics and the degree of grazing impacts. Where applicable, the grazing suitability assessment also included Proper Functioning Condition (PFC) protocols (USDI Bureau of Land Management, 1998). Forest Service policy requires meadows be at minimum properly functioning[1] (USDA Forest Service, 2004). Using grazing suitability and PFC protocols, the team provided recommendations for the suitability of meadows for commercial pack stock grazing, which were incorporated into Alternative 2 and Alternative 3. The information from the grazing area field evaluations used in this section is summarized in Table 3.34. More complete information is presented in Table 3.56 in the Grazing Resources section. These assessments are used for the soil quality, water quality, and geomorphology analysis elements.

Cumulative Effects Analysis

The Sierra NF Cumulative Watershed Effects (CWE) analysis method is based on Equivalent Roaded Acres (ERAs). This approach considers roads to be the dominant watershed disturbance and assigns weighting factors to other management activities in order to express their effects in terms of their equivalence to the disturbance of a road. The total percent of ERAs are calculated for subwatersheds, which are approximately 500-2000 acres in size. The ERA in each subwatershed is then compared to the lower Threshold of Concern (TOC), which ranges from 4-6%, based on the natural sensitivity of each subwatershed to disturbance. A CWE response would not be expected unless ERAs exceed the lower TOC in a subwatershed. Subwatersheds that are over their lower

[1] A wetland or riparian area is considered to be at PFC if it can withstand high flows, filter sediment, improve ground-water recharge, and provide habitat for aquatic and riparian-dependent species.

TOC are carried forward in a detailed assessment, in which existing data and / or field review by the hydrologist and aquatic biologist are used to determine the risk of a CWE response that would result from the project. This method specifies weighting factors for a variety of vegetation management disturbances which are typical of forest management based on values that are used by National Forests across California and modified to reflect local conditions on the Sierra NF. However, coefficients have not been developed and validated for the types of disturbances that occur in wilderness areas, including those that would occur under this project. Only the areas outside of wilderness (NED, CLO, EDI, CHQ, FLO, HNE, HNW, TUL, and WIS) were analyzed using the established ERA method (DeGraff 2005). The spatial boundary for this analysis included the subwatersheds that contain at least a portion of an analysis unit. The temporal boundary went from 30 years in the past (following the ERA methodology), and 20 years into the future, which is the term of the permit.

Areas within wilderness (KAI, COO, DIL, NEL, and HEL) were analyzed using a method that was developed for the 2005 Pack Stock Management EIS (Gott and Sanders 2006). It was crafted specifically for wilderness areas and follows the direction in FSH 2509.22 Chapter 20 – Cumulative Off-Site Watershed Effects Analysis. For these areas, existing information was compiled for a baseline assessment by estimating the acreage of existing disturbances in the wilderness areas, characterized by disturbed meadows, trails, and campsites. There are no weighting factors – each disturbance is considered to have the same weight. The percentage of disturbance is calculated by HUC6 watershed (the area within wilderness only), which is a larger analysis unit than the ERA method uses (the acreages are displayed in Table 3.32). The percentage of disturbance in each wilderness watershed is compared to the TOC identified in the 2005 Pack Stock Management EIS, which is 0.75%. The TOC is lower than the ERA method because the impacts tend to be more focused in meadows and areas with direct connectivity to the stream network, and because these higher elevation areas tend to be more sensitive and less resilient to disturbance. The spatial boundary for this analysis included the HUC6s that contain at least 5% of their area within the Kaiser or Dinkey Lakes Wilderness. The temporal boundary included all past actions with lingering effects (which varies by the action and its effects, but includes, for example, historic grazing with lingering effects to meadows), to 20 years into the future, which is the term of the permit.

The results of the baseline assessment are shown in Table 3.32. Those watersheds with disturbance levels over the TOC were carried forward into a detailed assessment, which is included in the project record and summarized in the Environmental Consequences Overview section.

*Table 3.32: The estimated percent of HUC6 watershed area disturbed within the Kaiser and Dinkey Lakes Wilderness Areas, shown in order of highest to lowest disturbance. Two HUC6 watersheds are over the 0.75% TOC and are shown with an * next to their names. Only non-barren acreage is considered in the disturbance calculation (2005 Pack Stock Management EIS).*

HUC 6 Name	HUC6 Acres	HUC6 Acres (non-barren only)	Acres of Trails	Acres of Camp Sites	Acres of Disturbed Meadow	Estimated Total Disturbed Area	Estimated % of Watershed Area Disturbed
Huntington Lake*	21,342	20,279	17	3.6	490	511	2.5%
Upper Dinkey*	2,731	2,221	5	15	31	51	2.3%
Kaiser Creek	9,853	8,118	8	12	6	26	0.3%
Upper North Fork Kings	17,077	15,204	10	4	0.4	14	0.1%

In addition to these assessments, cumulative effects are described in relative, qualitative terms.

3.2.1.3 Overview – Common to All Analysis Units

Affected Environment

This section will briefly discuss the affected environment at an analysis area scale. Site-specific information, including summaries of field assessments, can be found in the individual AU sections.

Soils - Soils in the project area tend to be "young" due to short growing seasons and relatively recent glacial periods in the Pleistocene. In many cases, soils are deep to very deep, even when occurring in patches within rock outcrop. The High Sierra Area Soil Survey (1995) states that most non-meadow soils in the area are highly susceptible to sheet and rill erosion due to their coarse texture, low organic content, and natural water repellency (USDA Forest Service 1995, p.23). Some areas, especially in the FLO, KAI, DIL, HEL and NEL AUs, have a large proportion of rock outcrop. These areas are not sediment sources but can produce a large amount of runoff, which contributes to erosion of soils found downslope. Meadow soils differ from surrounding landscapes as they have developed primarily in alluvial (water-derived) deposits and tend to be very fine-grained with shallow water tables (USDA Forest Service, 1995, p.16-31). Soil productivity varies in the project area. Generally, the more productive soils are found in meadows.

The acres of soils that are currently potentially affected by pack station uses include:

- 69 acres of permitted facilities
- 55 acres of system trails (152 miles, 3 ft wide)
- 17 acres of use trails (46 miles, 3 ft wide)
- 36 acres of pastures
- 269 acres of other meadows recently grazed by pack stock
- 35 acres of campsites within wilderness

Table 3.33 shows the acres of soils potentially affected within each analysis unit. Permittees are currently authorized to use any existing legal campsite, and campsite inventories exist only in the wilderness AUs. Therefore, the estimated acres of soils potentially affected at campsites include all inventoried campsites, but in wilderness areas only. NED and CLO are the only non-wilderness AUs containing campsites that are used by pack stations and that are not included in these estimates.

Table 3.33: Acres of soils currently potentially affected by pack station uses.

AU	Facilities and Campsites	Camp sites	System Trails	Use Trails	Pastures *	Other Riparian Areas*
NED	7.7 ac YTPS Jackson Road Headquarters	unknown	8 ac	7 ac	18 ac	23 ac
CLO	17 ac MPS Miller Meadow Headquarters	unknown	10 ac	2 ac	-	-
EDI	~8 ac HSPS Main Pack Station and D&F Edison Spike Station	-	3 ac	1.5 ac	-	-
CHQ	-	-	1 ac	-	-	-
FLO	~10.25 ac facilities HSPS Florence Lake Spike Station, LVPS Headquarters, and MTR Florence Lake Resort	-	0.5 ac	-	-	-
KAI	-	14 ac	10.5 ac	0.5 ac	-	-
HNE	~7 ac D&F Main Pack Station and Badger Spike Station	-	3 ac	2 ac	-	-
HNW	-	-	3 ac	-	-	-
COO	-	2 ac	4.5 ac	0.5 ac	-	246 ac
DIL	-	15 ac	3 ac	0.75 ac	-	-
HEL	-	-	3.5 ac	-	-	-
NEL	2.1 ac CPO Cliff Lake Trailhead Spike Station, near NEL	2 ac	3.5 ac	0.5	-	-
DFC	5.7 ac CPO Dinkey Creek Site	-	1 ac	1 ac	~18 ac (Glen and Mill Meadows)	-
TUL	5.6 ac facilities CPO Pole Corral Headquarters	-	-	-	-	-
WIS	3.4 ac CPO Woodchuck Trailhead Spike Station	-	-	1.5 ac	-	-
Near	1.9 ac	-	-	-	-	-

AU	Facilities and Campsites	Camp sites	System Trails	Use Trails	Pastures *	Other Riparian Areas*
AA/JM	CPO Maxon Trailhead Spike Station					

* Some meadows listed in Tables 2.22 and 2.23 have been analyzed for future pack stock grazing but are not currently being used. Acreages in this table include only the currently / recently used pastures and grazing areas.

Hydrologic setting and geomorphology - Precipitation varies from approximately 15 to 60 inches across the SNF, generally increasing with elevation, and from south to north. Most precipitation occurs in winter. Precipitation in lower elevation valleys falls as rain and snow, and a greater percentage falls as snow with increasing elevation. At the elevations where the Analysis Units are located, winter snow accumulations occur, and spring snowmelt and runoff follow. Late spring and early summer conditions tend to include moist or wet soils at facilities, on trails, and in grazing areas. At the higher elevations, patchy snow accumulations persist later and serve as sources of water that keep their immediate area wet.

Few surveys to characterize channel geomorphology have been performed in the analysis area. Site specific information is presented in the AU sections for meadows that were assessed by the IDT for pack stock grazing. Generally speaking, stream geomorphology across the analysis units ranges from steep, straight bedrock channels to meandering streams in gently sloping meadows. Many of the streams are either bedrock- or boulder-controlled, and not susceptible to alteration from recreational activities or land management. Meadow channels, which are typically dominated by fine sediment, are sensitive to disturbances and susceptible to channel alteration. Sediment loads in streams are variable, depending on the sediment source material, differences between snowmelt and rainfall patterns, and relative position in the watershed. In general, sediment storage increases and sediment particle size decreases in a downstream direction. Steep channels typically store very little fine sediment. Channels with gentle slopes are more likely to accumulate sediment.

Historic grazing has influenced the current condition of many meadows on the SNF (Ratliff, 1985). Livestock grazing (cattle, sheep, and pack stock) has occurred throughout the area from the mid 1800s until present time (Ratliff 1985; USDA 2005). Documentation suggests that extensive cattle and sheep grazing and pack stock use between the mid 1800s and the early 1900s denuded vegetation, compacted soils, and altered stream morphology in Sierra Nevada Wilderness areas (Muir 1894; Kondolf et al. 1996; USDA 2005). These changes likely contributed to headcutting, stream incision and lowering of the water table. Effects are still evident today in some meadows in the analysis area. The High Sierra Soil Survey notes that some meadows in the survey area appeared to have lost over a foot of topsoil during this early period (USDA 1995). Historical grazing, including sheep, cattle, and pack stock, was many times greater in numbers (stock nights), for a longer season of use, and more widespread than is permitted today (Sierra NF 2200 Files, various dates). We assume that historical pack stock grazing contributed to the alteration of meadow and stream hydrologic function that was observed

in some meadows. In some cases it is difficult to separate historic from recent impacts to channel and meadow conditions.

There are approximately 8 mi of perennial stream channels that are located within currently permitted facility areas, pastures, or other recently grazed meadows (4.6 mi of the total are located in Rock Meadow in the COO AU, which has not been assessed by the IDT). Grazing area assessments, including PFC analyses conducted in the analysis area, are presented in Table 3.34. A 'Minor departure' from RCOs indicates that one or more RCOs is not fully met. A 'No' in the RCOs column indicates that one or more RCOs with a concrete standard (e.g., 'maximum 20% stream bank disturbance', or 'stream rating is PFC') is not met.

Table 3.34: Summary of stream geomorphology and meadow function, and current status of RCO consistency, from grazing area assessments. PFC = Proper Functioning Condition; FAR = Functioning At Risk

Analysis Unit	Location	PFC Rating	Other Observations	Meets RCOs?
NED	Bare Island Meadow	Visually rated at PFC	No compaction, sod fragmentation, or hydrologic alteration.	Yes
	Biledo Meadow	PFC	Compaction and sod fragmentation present on up to 5% of meadow. Some surface water diversion due to old road, slight hydrologic alteration.	Minor departure
	Buffin Meadow	Visually rated at PFC	Compaction on more than 15% of meadow area. No sod fragmentation. Erosion and evidence of hydrologic alteration.	Minor departure
	Dutchman Lake Meadow	Visually rated at PFC	Slight compaction on <5% of meadow. No sod fragmentation or hydrologic alteration.	Yes
	Grizzly Creek Meadow	Visually rated at PFC	Compaction and sod fragmentation on <5% of meadow. No hydrologic alteration.	Yes
	Lower Iron Creek Meadow	No stream channel	No compaction, sod fragmentation or hydrologic alteration.	Yes
	Quartz Meadow Complex	Visually rated at PFC	No compaction, but sod fragmentation on <15% of meadow. Spring channel downcutting and hydrologic alteration.	Minor departure
	Soquel Meadow	Visually rated at PFC	Compaction, sod fragmentation, and slight hydrologic alteration on <5% of meadow.	Yes
	Tin Can Meadow	Visually rated at PFC	Compaction on <15% of meadow. No sod fragmentation. Slight hydrologic alteration.	Minor departure
	Upper Goat Meadow	PFC	Compaction on <5% of meadow. No sod fragmentation. Slight hydrologic alteration.	Yes
	Upper Iron Creek Meadow	Visually rated at PFC	No compaction or sod fragmentation. Stable headcut has affected hydrologic function.	Yes

Analysis Unit	Location	PFC Rating	Other Observations	Meets RCOs?
CLO	Soldier Meadow	PFC	Compaction and sod fragmentation on <15% of meadow. Slight hydrologic alteration, including small headcut in center of meadow.	Yes
EDI	No grazing areas are located in this AU.			
CHQ	No grazing areas are located in this AU.			
FLO	No grazing areas are located in this AU.			
KAI	NE Nellie Lake Meadow	Visually rated at PFC	Compaction on <15% of meadow, and sod fragmentation on <5%. Slight hydrologic alteration, including small headcut.	Yes
	Nellie Lake Meadow	No stream channel	Compaction on <15% of meadow, and sod fragmentation on <5%. Meadow is wet, and has slight hydrologic alteration.	Yes
HNE	No grazing areas are located in this AU.			
HNW	No grazing areas are located in this AU.			
COO	Two grazing areas in this AU, Rock Meadow and Perkins Camp Meadow, have not yet been assessed.			
DIL	Miner Camp Meadow	FAR	Compaction and sod fragmentation on <15% of meadow. Historic channel incision. Channel sinuosity is lower than expected. A small portion of channel at the lower end of meadow does not have adequate riparian cover to protect banks.	No
	SE 1st Dinkey Lake Meadow	Visually rated at FAR	Soil too moist to assess compaction. Sod fragmentation present. Channel incision and stable headcut from historic impacts.	Minor departure
	South Lake Meadow	Visually rated at PFC	No compaction, sod fragmentation or hydrologic alteration observed.	Yes
HEL	No grazing areas are located in this AU.			
NEL	Little Lake Meadow	No stream channel	No compaction, fragmentation, or hydrologic alteration. No evidence of historic impacts.	Yes
DFC	Mill Meadow	Visually rated at PFC	Compaction and sod fragmentation on <15% of meadow. Slight hydrologic alteration. Historic impacts from adjacent mill. Meadow contains an active headcut and an area of active gullying, and recent streambank trampling. Also evidence of stable, inactive headcuts and gullies.	No
	Glen Meadow	Needs to be assessed	Compaction on <5% of meadow, sod fragmentation on <15%, including in fen. Sight hydrologic alteration, inactive headcut. Recent streambank trampling.	No
TUL	No grazing areas are located in this AU.			
WIS	No grazing areas are located in this AU.			

Water Quality - Surface water quality on the SNF is generally good. No lakes or streams in the project area are listed on the 2002 California 303(d) list (the most recent list to be approved by the EPA) of impaired water bodies as water quality limited. Quantitative water quality data was not collected as part of this project, in part because sample

collection and delivery to a water quality laboratory is logistically challenging and expensive. In addition, field assessments discovered few water quality concerns associated with the project that would have justified the expense of large-scale sampling. The limited data that has been collected in the project area (described below) suggest that fecal coliform meets CVRWQCB standards at some of the more heavily-used destination areas. In addition, because beneficial uses (such as swimming, municipal drinking water, and fish spawning habitat) were not observed to be impaired, the collection of water quality data was not undertaken for this project.

Three coliform samples were collected from each of four lakes in KAI. Fecal coliform levels were above the detection limit (2/ml) in only one of the 12 samples collected. The data from this study is presented in Table 3.35. Values are reported as they came from the Fresno County Public Health Lab, in #/ml. (For comparison of this data to the water quality standard of #/100ml, multiply each number by 100.)

Table 3.35. Fecal coliform samples collected at four lakes in KAI in September 2000.

Site name	# hiker nights*	Cattle use noted at time of sample collection	Sample #	Fecal coliform
Jewell Lake	8	Rare (rocky shoreline)	1	<2
			2	<2
			3	<2
College Lake	4	Yes	1	<2
			2	<2
			3	<2
George Lake	383	Yes	1	<2
			2	<2
			3	<2
Upper Twin Lake	1077	Yes	1	8
			2	<2
			3	<2

*Hiker nights were derived from permits issued for overnight wilderness use. No permits were issued to the public for overnight pack stock use at these locations in 2000.

Cattle and packstock use were not assessed as part of this sample collection effort. Actual cattle use levels are not known, other than observations that cattle don't use Jewell Lake, whereas there was evidence of heavy use by hikers and cattle at Upper Twin Lake. Privately-owned horses and other pack animals may use this area on day trips without permits. It is unknown whether these locations were used by D&F for commercial operations during the 2000 season.

Other data relevant to water quality effects was collected during IDT assessments, including evaluations of facilities, campsites, and trails (as described in the Methodology section.) As described in Section 1.5, a State-approved system for implementing and monitoring BMPs is the method followed by the Forest Service for protecting water quality. Facility and campsite assessments and BMP evaluations that were performed for this project are summarized in Table 3.36.

Table 3.36: Summary of BMP evaluations at facilities and campsites.

Analysis Unit	Assessment Area	BMP Implementation	Are current practices effective for preventing WQ impacts?	Existing Water Quality Impacts
NED	YTPS Jackson Road Headquarters	Meets requirements	Yes	None
	11 campsites assessed*	4 Meet requirements 4 Minor departure 3 Major departure	4 Yes 2 Minor impacts 5 Moderate impacts	Two sites with minor impacts affecting meadows and streams; Five sites with moderate impacts to meadows and/or streams
CLO	MPS Miller Meadow Headquarters	Major departure	Moderate impacts	Miller Creek flows through stock corral
EDI	D&F Edison Spike Station	Meets requirements	Yes	None
	HSPS Main Pack Station – Base Camp	Meets requirements	Yes	None
CHQ	No facilities or campsites used by pack stations are located in this AU			
FLO	HSPS Florence Lake Spike Station	Major departure	Moderate impacts	Sediment and potentially manure reach creek due to hitching rail location
	LVPS Headquarters at Florence Lake	Meets requirements	Yes	None
	MTR Florence Lake Resort	Meets requirements	Yes	None
KAI	4 campsites assessed*	1 Meets requirements 3 Minor departure	2 Yes 1 Minor impacts 1 Moderate impacts	One campsite with evidence of minor sediment reaching Walling Lake, and one contributing moderate sediment to adjacent stream
HNE	D&F Main Pack Station – Base Camp	Moderate departures	Moderate impacts	Runoff from facility contributes sediment. No concern for manure impacts to WQ.
HNE	D&F Badger Spike Station	Minor departure	Minor impacts	Storm-generated sediment observed to originate at facility may reach creek, due to rare precipitation event
HNW	No facilities or campsites used by pack stations are located in this AU			
COO	No facilities are located in this AU. No campsites were assessed.			
DIL	5 campsites assessed*	2 Meet requirements 3 Minor departures	4 Yes 1 Minor impacts	One campsite with evidence of slight sediment reaching stream
HEL	No facilities or campsites used by pack stations are located in this AU			
NEL	4 campsites assessed*	3 Meet requirements 1 Minor departure	3 Yes 1 Minor impacts	One campsite with evidence of minor sedimentation into Cliff Lake
	CPO Cliff Lake Trailhead Spike Station (near NEL)	Meets requirements	Yes	None

Analysis Unit	Assessment Area	BMP Implementation	Are current practices effective for preventing WQ impacts?	Existing Water Quality Impacts
DFC	CPO Dinkey Creek Site	Minor departure	Minor impacts	Small amount of sediment from facility may reach stream
TUL	CPO Pole Corral Headquarters	Meets requirements	Yes	None
WIS	CPO Woodchuck Trailhead Spike Station	Minor departure	Minor impacts to isolated meadow	Minor trailing through small seep / meadow
Near AA/JM	CPO Maxon Trailhead Spike Station	Meets requirements	Yes	None

* The campsites assessed in the wilderness AUs are not used only by commercial packers and are not managed through pack station SUPs, but through the 2001 Wilderness Plan and the Wilderness Program. YTPS campsites in NED are managed under their SUP, and concerns identified at these sites are addressed by design measures in this EIS.

The trail assessments rated trails based on their overall condition and resource impacts. In most cases, resource impacts related to trails were due to poor trail alignment on steep slopes, impacts to meadows, or the need for trail maintenance. The contribution of pack station use on the conditions reflected in these trail ratings varies between sites, and is discussed in the AU sections. Table 3.37 summarizes the watershed and water quality concerns identified through trail assessments. The trail segments vary in length from 0.1 mile on short use trails to over 5 miles on some of the arterial trails into the Kaiser and Dinkey Lakes Wildernesses.

Table 3.37: Summary of watershed concerns related to trails. Trail ratings are on a scale of 0 – 5, with 0 = a very stable trail with no repair or maintenance needed and 5 = a severely degraded trail with substantial maintenance or reconstruction needs.

Analysis Unit	Number of Trails Assessed and Trail Condition Ratings / Watershed Concerns
NED	37 segments assessed 23 with identified erosion problems
CLO	9 segments assessed 8 segments rated '0' to '2', with only minor watershed concerns 24E25 (Norris Lake Trail) rated '3' due to erosion and unstable stream crossings
EDI	6 segments assessed 6 segments had no identified watershed concerns
CHQ	No trails assessed
FLO	3 segments assessed No identified watershed concerns
KAI	8 segments assessed 5 segments rated '1' and '2', each with stream crossing stabilization needed. 3 segments rated '3' for erosion and maintenance needs (1 of these has no WQ impact)
HNE	4 segments assessed 2 segments rated '2', with localized watershed concerns 26E35 (Potter Creek Trail) rated '3' due to sedimentation into Potter Cr 26E39 (Potter Pass Trail) rated '4' due to sedimentation into Potter Cr
HNW	1 segment assessed No identified watershed concerns
COO	4 segments assessed

Analysis Unit	Number of Trails Assessed and Trail Condition Ratings / Watershed Concerns
	3 segments rated '0' and '1' show no watershed concerns 27E08 (Black Peak Trail) rated '3' due to erosion and maintenance needs
DIL	5 segments assessed 3 segments rated '0' or '1', generally stable but areas of multiple trails, need maintenance and improved stream crossings. 2 segments rated '3' due to impacts to meadows and maintenance needs.
HEL	No trails assessed
NEL	2 segments assessed One segment rated '1', however, localized erosion occurs One segment rated '2', some erosion on steeper portions of trail
DFC	2 loop rides (6 segments) assessed 5 segments rated '1' 1 segment (DFC01) rated '3' due to stream crossing erosion into Glen Meadow Cr
TUL	No trails are located in this AU
WIS	1 segment assessed Localized watershed concerns identified due to trail erosion and 1 stream crossing.

Environmental Consequences

Alternative 1

Direct Effects

Soil Quality: Soil quality would improve. Without the direct soil impacts caused by pack station uses, soils that are impacted primarily by the pack station operations, such as headquarters and base camp areas, would slowly recover over time by becoming less compacted. Increased vegetation cover would add organic matter to soils and infiltration would increase. This would occur on up to 69 acres that are currently occupied by permitted facilities: portions of the permitted areas are not currently compacted and therefore would not improve.

The removal of commercial pack stock grazing from 269 acres of meadows and 36 acres of pastures would reduce trampling and improve soil quality in these meadows. Ongoing recovery from historic impacts would be accelerated.

Commercial pack stock use of trails would cease, and the quantity of soil eroded from trails would be reduced by the quantity of soil displacement caused by those animals. This would occur only on the trails where pack stock use contributes to erosion. On stable trails where little erosion occurs with pack stock use, there would be no reduction. The reduction of impacts is expected to be disproportionately smaller than the reduction in use that would occur with the removal of commercial pack stock, due to the non-linear relationship between use levels and impacts described in the Background section.

Relative to the proposed action and existing condition, soil quality would be the most improved under the No Action alternative due to reductions in meadow trampling, soil compaction and erosion from facilities and, to a lesser degree, trails.

Water Quality: The direct impacts to water quality and hydrology being caused by commercial pack station operations would not occur in up to 8 miles of perennial streams

located within recently used concentrated use areas (facilities, grazed meadows and pastures). Waste contamination of lakes and streams caused by commercial pack animals and pack station customers would cease under this alternative. The reduction in the risk of bacterial contamination of surface water is expected to be directly proportional to the reduction in animal numbers – the curvilinear relationship that exists for trampling effects does not apply to the effects of fecal material.

Hydrology and Geomorphology: Changes in localized hydrology due to facilities would be reduced as soil infiltration increases. Hydrologic alteration of meadows due to compaction from historic uses would recover more quickly in grazing areas that, under this alternative, would not be used by commercial pack animals.

RCOs: There would be less activity in recently grazed meadows (listed in Table 3.55 in section 3.3.4) that could potentially conflict with meeting RCOs. However, the meadows identified in Table 3.34 that do not meet RCOs would continue to not meet RCOs, because the reasons for not meeting RCOs would persist without pack station use in these areas.

Indirect Effects

Soil Quality: Soil displacement and erosion would be reduced. This benefit would be greatest at the sites where facilities are removed, in recently grazed meadows, and perhaps at the edges of some large campsites used by commercial stock. As soils become less compacted, there would be greater water infiltration and therefore less runoff and erosion.

The trails section indicates that the stability of trails that are currently heavily used by commercial pack stock would gradually improve over time if this use is discontinued. This would result in less trail erosion in these areas.

Water Quality: Indirect effects of commercial pack station activities to water quality would be reduced over time. Downstream water quality would be improved by eliminating sources of contamination associated with pack station operations, such as animal waste. This reduction would occur immediately.

Sedimentation would decrease over time because less soil would enter streams from trails due to decreased animal numbers. Less meadow erosion would occur due to decreased trampling of grazing areas. Vegetative cover would improve due to the reduction in pack stock use, which would also reduce erosion and sedimentation. Some soils at facility locations, campsites, and meadows grazed by commercial pack stock would be less compacted over time, allowing more water to infiltrate, thereby recharging local water tables and reducing erosion from runoff events.

The gradual improvement in trail stability and decrease in erosion noted above would translate into reduced quantities of sediment entering streams from those trails that currently receive heavy commercial pack stock use. Given that continued use by other

user groups would occur, the magnitude of this improvement and the time period over which it would occur are uncertain.

Hydrology and Geomorphology: Stream geomorphology in meadows may also improve; with reduced grazing there could be a reduced risk of new headcut erosion being initiated in the future, due to the reduced trample and chisel disturbance on channel banks and in meadows by grazing pack stock, and reduced erosive power generated by lower runoff rates. Headcuts larger than 1-2 feet high would likely continue to erode unless they were stabilized. Small headcuts may stabilize themselves through the binding effects of vegetation as it recovers due to reduced grazing pressure.

RCOs: The potential for not meeting RCOs in the assessed meadows in the future would be reduced due to the indirect effects on Hydrology and Geomorphology described above.

Cumulative Effects

Cumulative watershed effects (CWEs) were examined for the non-wilderness AUs using the ERA method to compare the impacts of pack station use to other management activities dating back 30 years (DeGraff 2005). The additional ground disturbance resulting from pack station use is attributable to the facilities and use trails. In seven of 37 subwatersheds analyzed, removal of existing pack station disturbances would lower ERAs by an inconsequential 0.1 or 0.2% (relative to TOCs that range from 4 – 6%). In the other 30 subwatersheds, the reduction in ERAs was calculated to be 0%.

Cumulative watershed effects for the wilderness areas were assessed using the methodology developed for the 2005 Pack Stock Management EIS (Gott and Sanders 2006). The method is similar to the ERA method, except that the main disturbances that occur are trails, campsites, and alteration of meadows, which are all weighted equally, and the TOC applied to wilderness areas is 0.75%. This analysis found that two HUC6 watersheds exceed the TOC; Huntington Lake, which contains KAI and COO, and Upper Dinkey, which contains DIL. The results of the baseline analysis are shown in Table 3.32.

The Detailed CWE Analysis Report (Gott and Sanders 2006) for these two HUC6s indicates that there would be no measurable improvement in either of these HUC6 watersheds due to implementation of Alternative 1. Concentrated pack station activities cover a very small proportion of any given watershed, and the contribution to the condition of stream geomorphology and water quality are local and minor relative to the other factors that influence these conditions. Removal of these activities would not result in a detectable change in CWEs (or in watershed condition) in any HUC6 watershed.

The 2005 Pack Stock Management EIS concluded that CWEs may be occurring in Edison (contains EDI) and Granite (contains a portion of CLO) watersheds. These effects were attributed to historic and recent cattle grazing, with little contribution from commercial pack stock. The analysis concluded that implementation of the selected alternative would not change the potential for CWEs in these watersheds because the

contribution from pack stock management was much smaller than the contribution from cattle grazing.

At pack station facilities, there would be little or no manure to potentially contribute pathogens to nearby surface water. Fewer animals would use trails, and the amount of manure on trails would be decreased. These effects would result in an immediately lower risk of pathogen contaminated water. Because cattle grazing would still occur in most of the AUs, and private pack stock would still use the trails, there would still be a risk of contamination, but it would be lower than under the existing condition, Alternative 2, and Alternative 3.

In the long-term, the decrease in erosion and sedimentation due to the gradual improvement of trail stability on trails that are currently heavily used by commercial pack stock would result in these trails contributing less sediment, and possibly less concentrated water flow, to streams. This would reduce the contribution of the trails to cumulative watershed effects, although it is not expected to result in a detectable improvement in stream channel condition (sedimentation or geomorphology). Outside of wilderness areas, where many other land management activities and uses occur, the contribution of the trails is generally a smaller contribution to the total disturbance and to the cumulative condition than within wilderness areas, making it less likely that the decrease in sediment would be detectable.

At a local scale, such as at individual pack stations, removal of commercial pack stock use could be a large contributor to improved conditions. The beneficial effects in individual meadows, in conjunction with past grazing reductions across the forest, would contribute to improved meadow hydrologic function, stream geomorphology, and soil quality in these meadows. In meadows where commercial pack animals are the only grazing use, discontinuing commercial pack stock grazing would likely result in more rapid recovery from recent and historical grazing impacts than the other alternatives.

Other actions have already been taken to improve watershed condition across the analysis area, including watershed restoration projects, implementation of BMPs, and reductions in grazing. This alternative would make another small contribution toward reducing the cumulative total bare soil, compacted soil, and sedimentation into surface water over the analysis area. The no action alternative would result in slight short-term and slight to moderate long-term improvement in soil quality, water quality, and hydrologic processes across the analysis area. These improvements may be noticeable at the local scale (e.g. an individual stream reach or a particular meadow), but difficult to detect at the AU, HUC6, or landscape scale.

The riparian and hydrologic management activities that will occur under the FERC License Agreement will have effects downstream of Florence Lake and the Crater Diversion in FLO, Lake Thomas A. Edison and the Bear Diversion Dam in EDI, and Huntington Lake, downstream of the AUs and of the cumulative effects analysis area. The current riparian and hydrologic condition of these areas has been drastically modified by the flow modifications made for hydropower development, which have been in place

for up to 80 years. The new FERC License, which is currently being negotiated, is likely to include flow releases specifically for riparian maintenance, increases of instream flows, and the possible removal of the Crater Creek diversion, which is located in AA/JM. These measures would improve riparian conditions, transport sediment and thereby reduce stream sedimentation, and improve stream channel function. These are discussed individually in the affected AUs.

The level and proportion of commercial and overall use, and the effects of the trails on soil and water are somewhat unique in each AU. The differences in direct, indirect, and cumulative effects of Alternative 1 that result from these differences are discussed in the individual AU sections.

Alternative 2

Direct Effects

Soil Quality: The commercial pack animals authorized under this alternative would likely cause trampling and soil displacement on trails. These impacts are described in the Background discussion of this section and in the Background of the Trails section (Section 3.1.3). Because the level of use that would occur under this alternative is similar to the existing condition, the impacts of this alternative are likely to result in conditions similar to those documented by the IDT in recent years (i.e., the conditions described in the Affected Environment section).

Soil disturbance and compaction in 13 grazed meadows would result from this alternative, which would approve certain areas for grazing but would prohibit grazing in areas determined not suitable. Where grazing would be permitted, start dates and utilization standards would be applied to ensure that standards and guidelines are met.

Direct impacts to soils may also occur at heavily used campsites, which tend to become enlarged by stock group use. Enlarged sites are more common in wilderness areas where pack stock overnight because they cannot return to the pack station in one day, although they may also occur where pack stock drop off large quantities of gear or groups of campers even if the stock do not overnight. Direct impacts to soils from enlarged campsites were not observed during visits to various AUs in the project area. Because the 2001 Wilderness Plan contains direction to control campsite size, significant direct impacts to soils from oversized campsites are not expected to occur under the proposed action alternative.

Small scale soil disturbance may occur when pack stock travel off trail to get around barriers such as downed trees. These disturbances may result in localized impacts to soil quality but are not expected to cause widespread or long term soil damage.

Water Quality: The proposed action may result in direct impacts to water quality from animal and human waste introduction into water bodies. A recent study in the Sierra Nevada suggests that the water quality objective for bacteria may be exceeded in areas with pack animal use (Derlet and Carlson 2006). Others note that there is no evidence that wilderness water is a source of bacterial illness for backcountry users (Welch 2004).

Very little fecal coliform data has been collected in the project area; 12 samples were collected from 4 lakes over one weekend in September 2000. One sample (8%) from Upper Twin Lake exceeded 400/100ml. All other samples, including two from the same lake, were below the 200/100ml detection limit of the lab. The Background section describes this issue in more detail. Because the number of animals and amount of permitted use would be about the same as the existing condition, the risk of bacterial contamination of surface water would remain about the same.

Sediment would be delivered to surface water as a result of this alternative. The Background section describes how pack stock use on trails, campsites, and grazing areas can result in erosion and sedimentation. The amount of sedimentation is expected to continue at rates similar to the existing condition, which varies across the project area. Relevant site-specific observations about water quality impacts are presented in the AU descriptions.

This alternative contains specific measures at 11 locations to reduce direct impacts to water quality and / or comply with BMPs. These measures are listed in Table 3.38. Several YTPS campsites in NED would be prohibited or relocated for various resource reasons, including water quality and meadow concerns. One corral in CLO and one hitching rail in FLO that currently contribute to water quality impacts would be relocated to provide adequate distance to surface water for filtration (they will be moved at least 100 feet from water, which will comply with BMPs). Erosion control would be applied at two facilities in HNE, and one facility in DFC would be monitored to determine if there is a need for erosion control measures. A small wet meadow with past minor trampling impacts in WIS would be avoided. These measures address the non-trail locations where the IDT found impacts to water quality that resulted solely from pack station operations.

The effects of this alternative on water quality are expected to be similar to the existing condition. Because existing water quality meets water quality objectives and would be maintained, this alternative complies with the Antidegradation Policy of both applicable Basin Control Plans.

Hydrology and Geomorphology: Pack station facilities may alter local hydrology due to compacted soils and physical structures. Runoff from rainstorms and snowmelt tends not to infiltrate as readily at the pack station facilities. Trails may also alter hydrology by diverting surface water, but because this would continue under any alternative, it is not considered to be an effect of this alternative.

RCOs: Pack stock grazing would be permitted in three meadows with minor departures from RCOs (Biledo, Buffin and Tin Can meadows) and in two meadows that do not meet RCOs (Mill and Glen meadows). Grazing management, including on-dates based on range readiness, use allocations, utilization standards, streambank disturbance standards, and protection of wet areas (and of the fen in Glen Meadow), would be applied to ensure that grazing use does not limit RCO attainment. Monitoring of Mill and Glen Meadows would also occur to ensure that the pack station operations in these areas do not limit

RCO attainment. Refer to the Monitoring Plan in the ROD for more information about the monitoring.

Indirect Effects

Soil Quality: This alternative includes measures to control indirect impacts to soils. Grazing range readiness standards would help ensure that pack stock grazing activities would create less soil compaction, and smaller associated increases in soil erosion, relative to the existing condition. However, greater soil compaction and erosion would occur than under the no action alternative.

Indirect effects to soils due to increased runoff from system and use trails would continue. Erosion rates caused by pack stock traffic would continue at a rate similar to the existing condition. Campsites are likely to be slightly larger with pack stock support, with more soil erosion likely than under the no action alternative. Soil erosion rates would be similar to the existing condition.

Water Quality: Downstream increases in bacteria and sediment are the primary indirect water quality impacts that would occur. They would primarily occur downstream of stream crossings on trails, and could also occur downstream of the grazing areas that have stream channels to carry bacteria and sediment off-site. Facilities could also contribute some sediment or bacteria, and are discussed below.

Indirect effects of pack station facilities on water quality and hydrology may include sediment and manure transport to lakes and streams. The size, extent, and proximity of pack station facilities to water bodies affect the risks to water quality. At facilities where impacts were identified under existing conditions, measures were designed to reduce indirect effects on water quality (see Chapter 2, Alternative 2 – Proposed Action, and Table 3.38). Therefore, impacts to water quality resulting from facilities will decrease under this alternative compared to the existing condition, and BMPs will be met.

Table 3.38: Improvements to BMPs at facilities under Alternative 2 (from Alternative 2 – Pack Station Specific Direction, Chapter 2). Note: Other than YTPS designated campsites in NED, campsite departures from BMPs are addressed through Wilderness Management rather than under the special use permits for pack stations. Operators are not permitted to use sites that do not meet BMPs.

Analysis Unit	Facility / Site	BMP Improvement
NED	Lower Iron Creek Camp	Maximum 6 head of overnight stock permitted at this site due to size of acceptable stock holding area; another location specified for additional stock.
	Upper Iron Creek Camp	Camp relocated, and overnight stock area specified
	S. Fork Merced Camp	Overnight stock area moved away from water, riparian zone to be avoided.
	Dutchman Lake Camp	Camp prohibited – too close to water.
	Tin Can Meadow Camp	Camp prohibited – various resource concerns, including too close to water
	Grizzly Creek Camp	Camp prohibited – various resource concerns

Analysis Unit	Facility / Site	BMP Improvement
	Biledo Camp	Camp relocated. Water system design to be submitted for approval, will return water to Rainier Cr without causing erosion.
CLO	MPS Miller Meadow Headquarters	Modify corral to provide a 100-ft buffer between corral and stream and prevent sediment and manure from reaching Miller Creek.
FLO	HSPS Florence Lake Spike Station	Move hitching rail away from stream to prevent sediment and manure from reaching stream.
HNE	D&F Main Pack Station – Base Camp D&F Badger Spike Station	Apply erosion control measures to prevent sediment and manure from reaching streams.
DFC	CPO Pole Corral Headquarters	Monitoring of potential sediment movement from facility towards stream in order to determine whether special measures are required.
WIS	CPO Woodchuck Trailhead Spike Station	Trailing through small meadow within facility is prohibited.

At facilities, permitted uses are more controlled. Also, because on-site assessments concluded that most sites did not raise watershed concerns, and measures to meet BMPs will be implemented at the sites where concerns were identified, the effects of facilities on downstream sediment and bacteria are probably lower than that of stream crossings on trails and grazing areas where animals are closer to streams and more likely to affect them. Existing impacts at facilities were displayed in Table 3.36, and the corrective design measures are displayed in Table 3.38.

Hydrology and Geomorphology: This alternative would have indirect effects on hydrology caused by trampling in areas where pack stock congregate, such as grazed meadows, hitch lines, loading areas and corrals. In these areas, compaction could limit infiltration and increase runoff, and potentially increase erosion. Soil compaction, if it becomes widespread and severe in any of the 13 meadows approved for grazing, could result in altered hydrology or result in headcut erosion, which impacts channel geomorphology. However, grazing management, including on-dates based on range readiness, use allocations, utilization standards, streambank disturbance standards, and protection of wet areas (and of the fen in Glen Meadow), would limit the amount of disturbance and identify areas where changes in management are needed in order to prevent resource damage from exceeding these limits.

The altered hydrology at facilities could result in altered stream geomorphology of adjacent streams. However, based on IDT assessments of the facilities which concluded that there are currently no such impacts, this is unlikely.

RCOs: There is a risk of not meeting RCOs in the future in the meadows where grazing is permitted, due to the potential indirect effects on Hydrology and Geomorphology described above. Monitoring would mitigate this risk by indicating a need for a change in management if conditions trend away from meeting RCOs due to the effects of pack stock grazing.

Cumulative Effects

Cumulative watershed effects (CWEs) were examined for the non-wilderness AUs using the ERA method to compare the impacts of pack station use to other management activities dating back 30 years. The additional ground disturbance resulting from pack station use under this alternative is attributable to the facilities and use trails. In seven of 37 subwatersheds analyzed, pack station disturbances contribute an inconsequential 0.1 or 0.2% to ERAs (relative to TOCs that range from 4 – 6%). In the other 30 subwatersheds, the contribution to ERAs was calculated to be 0%. This analysis indicates that there would be minimal risk of a CWE response in these sub-watersheds (DeGraff 2005).

Cumulative watershed effects for the wilderness areas were assessed using the methodology developed for the 2005 Pack Stock Management EIS. This analysis (Gott and Sanders 2006) found that two HUC6 watersheds exceed the TOC; Huntington Lake, which contains KAI and COO, and Upper Dinkey, which contains DIL. The results of the baseline analysis are shown in Table 3.32.

In the Huntington Lake and Upper Dinkey HUCs, the majority of the disturbed area is in meadows that have evidence of alteration. The 2005 Pack Stock Management EIS found that meadow disturbance seemed to have a large contribution to CWEs. In the AUs that lie within the HUCs that are over their Threshold of Concern, only one meadow (NE Nellie Lake, in KAI) is approved for any grazing by commercial pack stock, so pack stock would contribute very slightly (a maximum of 16 stock nights per season) in one isolated area to disturbance in an area that has the most potential to affect CWEs. Trails are the disturbance feature that is the most likely to be impacted by pack stock use in this project, and descriptions of cumulative effects focus on the impacts related to trail use. Campsites can also be impacted, however, the number of campsites in Huntington Lake (KAI and COO) is fairly low (3.6 ac), and although there are a large number of sites in the Upper Dinkey watershed (15 acresin DIL), the commercial operators are not permitted to camp there with stock.

The Detailed CWE Analysis Report (Gott and Sanders 2006) for these two HUC6s indicates that the contribution of the pack station operations to CWEs would be very small in these AUs. This analysis finds that the downstream effects of the activities analyzed in this EIS are minor, and that the greatest potential for cumulative effects to occur would be in grazed meadows – in this case, only NE Nellie Lake Meadow. The specific protections that have been applied to this grazing area, including an IDT assessment of the meadow to determine suitability and application of standards and guidelines from the Pack Stock Management Guide (2001 Wilderness Plan, Appendix G) are expected to minimize impacts and keep them within standards. Through implementation of standards and guidelines, cumulative effects are not expected to occur.

The 2005 Pack Stock Management EIS concluded that CWEs may be occurring in Edison (contains EDI) and Granite (contains a portion of CLO) watersheds. These effects were attributed to historic and recent cattle grazing, with little contribution from commercial pack stock. The analysis concluded that implementation of the selected

alternative would not change the potential for CWEs in these watersheds because the contribution from pack stock management was much smaller than the contribution from cattle grazing.

The actions listed in Table 3.2 were considered in the analysis of cumulative effects. The contribution of unmanaged livestock grazing to cumulative effects was described in the Affected Environment section, and is considered to be the largest contributor to cumulative effects in the wilderness AUs. This was also reflected in the CWE assessments described above. Other contributors within wilderness are campsites and trails. The recreational use of campsites and trails creates sedimentation from these features, while the wilderness management and trail maintenance programs implement improvements to minimize sedimentation from these features. Implementation of the 2005 Pack Stock Management direction in AA/JM institutes controls on the direct, indirect, and cumulative effects of commercial operations. These areas flow into (or contribute to the same watersheds as) all of the AUs in this analysis, except DIL and DFC. The 2005 Pack Stock Management EIS analysis concluded that in most areas, the standards and guidelines would improve local or site conditions but would not likely alter cumulative effects because pack stock management as a whole was not a large enough factor of cumulative effects. The Trails analysis and the CWE Analysis for the Kaiser and Dinkey Lakes Wildernesses acknowledge that sedimentation is increased by some of these features at various locations in these wilderness areas, despite the programs that focus on trail maintenance and improvement and eradication of campsites that do not meet BMPs. However, both document that the incremental contribution of commercial pack station operations is a small proportion of the total impacts on trails. This finding is similar to the conclusions of the 2005 Pack Stock Management EIS, although many of the site-specific details are different.

Outside of wilderness areas, many more activities and disturbances contribute to cumulative effects. The vegetation management and infrastructure management activities in Table 3.2 were considered quantitatively in the ERA analysis described above. Ground disturbance related to the recreation management activities, such as trails and facilities, were also included in the ERA analysis. Qualitative consideration of the activities that occur in the AUs outside of wilderness concurs with the ERA analysis: the contribution of commercial pack stock operations to CWEs is minimal. Roads are widely regarded as the largest contributors to changes in hydrology and sedimentation in managed watersheds. Roads often alter hydrology by intercepting groundwater in road cuts and converting it to surface flow, and by collecting runoff and routing it directly to streams at stream crossings. The water that roads deliver to streams often carries sediment generated on the road cut and surface. Trails have similar effects, however, they occupy much smaller areas of the landscape than roads and create effects that are scaled down versions of road effects. On unstable trails, the type of user is relevant to the amount of sediment generated; hikers generally create less erosion on a stable trail than equestrians, pack animals, mountain bikes, or OHVs. In all AUs outside of wilderness (except for TUL and WIS, which are facilities), there are more miles of roads than trails. Maintenance of roads and trails creates short-term disturbance to soil that can result in short-term increases in sedimentation, but results in longer-term reductions in erosion and sedimentation, by

ensuring adequate drainage from the road or trail. Vegetation management activities, particularly timber harvest and fuels treatments, generally occur in several hundred acre blocks, and create ground disturbance with ground-based mechanized equipment such as tractors which very often create skid trails and log landings. Even when BMPs are applied, these actions are more likely to generate sediment than pack stock use of existing facilities, trails, and campsites.

Cattle grazing effects are similar to pack stock grazing effects, but occur over much wider landscapes than the proposed pack stock grazing. The incremental addition of pack stock grazing under this project, because it would be managed within established standards and guidelines, is not likely to result in cumulative effects such as increased bare ground, decreased meadow productivity, or hydrologic alteration, including stream channel incision. The recreational activity with the most potential to contribute to cumulative effects is OHV use. OHV trails create similar disturbances as roads, but due to the tendency of these trails to be steep and rugged, they are usually not maintained as well as roads and contribute more sediment. Illegal off-road OHV use creates new disturbances and is also a contributor to cumulative effects in some areas. Dispersed car camping sites are often located adjacent to creeks, and in areas with a high concentration of this type of use (in this analysis, the Upper Dinkey watershed), the compaction and erosion at these sites can also be a contributor to sedimentation and even to stream channel instability. Recreation residence tracts, organizational camps, resorts, developed campgrounds, and picnic areas all tend to concentrate recreational use. The streams and trails near these types of places tend to be heavily impacted.

The riparian and hydrologic management activities that will occur under the FERC License Agreement will have effects downstream of Florence Lake and the Crater Diversion in FLO, Lake Thomas A. Edison and the Bear Diversion Dam in EDI, and Huntington Lake, downstream of the AUs and of the cumulative effects analysis area. The current riparian and hydrologic condition of these areas has been drastically modified by the flow modifications made for hydropower development, which have been in place for up to 80 years. The new FERC License, which is currently being negotiated, is likely to include flow releases specifically for riparian maintenance, increases of instream flows, and the possible removal of the Crater Creek diversion, which is located in AA/JM. These measures would improve riparian conditions, transport sediment and thereby reduce stream sedimentation, and improve stream channel function. These are discussed individually in the affected AUs.

The cumulative effects to hydrologic resources and soil quality under the proposed action would be similar to the no action alternative at the analysis area, HUC6, and landscape scales. However, there would be areas with more adverse cumulative effects at the site scale, especially to soils, under this alternative. These sites are noted in the AU discussions that follow. Pack station permits would not trigger irreversible adverse effects to soil or water resources at any site.

The cumulative effects of Alternative 2 within individual AUs are discussed in the same section as the direct and indirect effects. Because this proposal analyzes essentially the

continuation of the existing pack station use and management, the total cumulative effect of this alternative in each AU is similar to the existing condition, and the incremental contribution is described by the direct and indirect effects.

Alternative 3

Destination zones would benefit soil and water resources in three ways: designated sites would meet BMPs; particularly sensitive areas would not be permitted for use; and impacts at designated areas would be monitored and management would be adjusted to ensure compliance with standards and guidelines.

Direct Effects

Soil Quality: The direct impacts to soils would be the same as under Alternative 2 at facilities and in grazing areas. Trails would also have the same effects as under Alternative 2. The effects of the few differences between approved and prohibited trails and designated Trail Classes that would occur between these alternatives are described in the AUs in which they occur.

At campsites, effects would be similar to Alternative 2 across the analysis area, but rather than occurring at any campsite selected by the packer, they would be limited to designated stock camps in the MWSR and the wilderness areas. There would be a reduced risk of long-term impacts to soils in destination zones, because these areas would be monitored for compliance with standards and guidelines.

Water Quality: Direct effects to water quality and hydrology would be the same as under Alternative 2 across the analysis area, with the exception of the wilderness areas where destination management would allow better control of on-site impacts. Designation of stock camps would ensure that camps comply with BMPs.

Hydrology and Geomorphology: Same as Alternative 2 (because grazing management would be the same).

RCOs: Same as Alternative 2 (because grazing management would be the same).

Indirect Effects

Soil Quality: Indirect effects to soils are also expected to be slightly lower under this alternative than under the proposed action. Across the analysis area the differences would be subtle, but they could be noticeable in the wilderness areas where destination quotas and designated stock camps would be established.

Water Quality: The difference between the proposed action and Alternative 3 would be most noticeable in the wilderness areas where destination quotas would be applied. The areas where direct soil impacts are lessened would, in turn, create fewer indirect effects on runoff, erosion and sedimentation processes.

However, trail conditions dominate the indirect effects to water quality and hydrology, and are expected to be essentially the same as Alternative 2, with a few differences in

proposed trail management affecting some sites. These sites are identified in the AU discussions and in the Trails section. Fecal coliform contamination would be the same as under Alternative 2, because it is related to trail and grazing area use which would be the same as under Alternative 2.

Hydrology and Geomorphology: Same as Alternative 2 (because grazing management would be the same).

RCOs: Same as Alternative 2 (because grazing management would be the same).

Cumulative Effects
Cumulative effects are expected to be essentially the same as described under Alternative 2. The differences in direct and indirect effects that would result at site locations from destination management and the few differences in permitted trails would be subtle enough to be lost at the AU, HUC6, project area, or landscape scale.

The cumulative effects of Alternative 3 within each AU are not discussed separately, but are included where necessary in the same section with the direct and indirect effects.

3.2.1.4 Analysis Unit Level Evaluation

NELDER (NED)

Affected Environment

The YTPS Jackson Road Headquarters was visited by the hydrologist and no concerns related to soils or water were identified. The facility has a septic system, with no known concerns for water quality issues.

Numerous system and use trails are used by YTPS in this AU. The system trails are also used by hikers and private equestrians. The use trails are used almost exclusively by YTPS, but also receive some private equestrian, hiking, biking, and OHV use. YTPS performs voluntary maintenance, including constructing waterbars, on many of their use trails.

Twenty-eight use trails and 9 system trails were assessed. Sixty-two percent of those surveyed had some type of watershed problem. The majority of problems were related to drainage (7 sites), stream crossings (6 sites), or meadows in close proximity to or crossed by trails (4 sites). Stock watering impacts were noted at two locations. Some of the more notable trail problems are on the YTPS ½- and 1-hour ride routes, where some trails are incised up to 24 inches deep. Use trail NED11 was impacting Tin Can Meadow and resulted in streambank instability at the stream crossing. In 2006, this trail was rerouted out of the meadow and armored at the stream crossing to minimize riparian impacts.

Use trail NED15 was assessed and noted to have highly pulverized soils, erosion, and up to 3 feet of incision. Three assessed use trails (NED22, NED23, NED28) would be approved under Alternative 3 but not under Alternative 2. NED22 was noted to be deeply

incised. NED23 had some erosion occurring at a stream crossing. There were no concerns identified on NED28. Trail NED25, which would be approved under Alternative 2 but prohibited under Alternative 3, is the access trail to Pike Camp, and causes impacts to a meadow.

Even though this AU is non-wilderness, all overnight use by YTPS would occur at designated stock camps under both Alternative 2 and Alternative 3. Eleven of these camps were assessed by the IDT (Tables 2.23 and 3.36). Six camps (Upper Iron Creek, S. Fork Merced, Tin Can Meadow, Grizzly Creek, Dutchman Lake, and Biledo) were located too close to water, and evidence of impacts to meadow function and water quality were found. At Lower Iron Creek Camp, the stock holding area appeared to be overused, resulting in bare ground and soil disturbance.

There are seven meadows in this AU that have been used for commercial pack stock grazing recently, and six additional meadows that were proposed for grazing. Eleven of these meadows were assessed by the IDT (Tables 2.21, 2.22, and 3.34). Seven of the assessed meadows were meeting RCOs. The four meadows described below were found to have minor departures from RCOs.

Biledo Meadow was assessed following the proper functioning condition protocol and rated PFC. However, evidence of slight hydrologic alteration from an old road was causing a minor departure from RCOs.

Buffin Meadow visually rated at PFC, but had altered hydrologic function due to trail impacts. This disturbance is a minor departure from RCOs.

Quartz Meadow Complex visually rated PFC. This meadow complex contains a fen. Stream channel instability and incision indicate a minor departure from RCOs.

Tin Can Meadow visually rated PFC, but shows evidence of slight hydrologic function alteration from trail NED11, and moderate compaction related to the impacts from the stock camp on the meadow's edge. (The trail was rerouted out of the meadow and armored at the stream crossing to minimize the impacts, but hydrologic recovery may take decades.) The hydrologic alteration and impacts from the camp at the meadow's edge (within the RCA) were causing a minor departure from RCOs.

Environmental Consequences

Alternative 1

Direct Effects and Indirect Effects

Soil Quality: Discontinuing use of the YTPS pack station on Jackson Road would allow the 7.7 acres of soils on site to recover over time. Recovery of the pack station facility area would reduce overland flow and erosion.

Impacts on system trails used by YTPS would be reduced. Trail stability would improve in the long-term. The condition of the use trails would probably not change: unstable trails with incision and erosion problems would continue to erode, while those trails that

are currently stable would remain stable or naturalize over time. The trails where YTPS would no longer perform maintenance could either become slightly more stable with the removal of pack stock or less stable due to lack of maintenance. Stock watering at streams would cease, and the two identified areas impacted by stock watering would recover.

Slight recovery of 23 acres of previously used grazing areas (Bare Island, Biledo, Upper and Lower Iron Creek, Tin Can, and Quartz), 18 acres of pasture (Soquel Meadow), and 13 campsites could also contribute incrementally to this slight sediment reduction.

Water Quality: As the stock watering area and some trails stabilize, sedimentation to streams would be slightly reduced. Fecal coliform would be reduced immediately.

Hydrology and Geomorphology: Commercial pack stock would not have the potential to affect hydrology and geomorphology on the Sierra NF. Conditions may improve in some areas, but the level of effects observed from pack stock use was generally low, so the potential for improvement is slight.

RCOs: There would be no risk of commercial pack stock use causing a departure from RCOs, but no improvement in RCO attainment would occur. See Environmental Consequences - Overview of Alternative 1.

Cumulative Effects

The contribution to stream sedimentation from commercial stock use would decrease, and volunteer trail maintenance performed by YTPS would also cease. Some use trails with existing erosion problems would see an increase in stability, but there is a potential that continued use by OHVs and bicycles could result in decreased trail stability on some routes, which would moderate the decrease in the contribution of these trails to cumulative effects (sedimentation).

Removing commercial pack stock grazing from the seven meadows listed above could result in an incremental decrease in trampling, compaction, bank trampling and chiseling, bank erosion, and animal waste deposition into surface water. Cattle would continue to graze in Bare Island, Biledo, Lower Iron, Upper Iron, Quartz, and Tin Can meadows, and would be permitted to utilize these areas within the same standards and guidelines that would have been required for combined use. Site visits concluded that actual use by cattle does not currently reach the maximum allowable use (up to 40 percent use) in these areas, and therefore use is expected to remain below this level.

Alternative 2

Direct, Indirect, and Cumulative Effects

Soil Quality: The total area of permitted facilities would increase from approximately 7.7 to 9.7 acres, and compaction, runoff, and potentially erosion would increase on the two additional acres. The construction plans must be approved prior to being implemented, and BMPs (short-term construction phase as well as long-term location, design, and operation) would be required to minimize impacts to water quality.

The effects of trail use on erosion would continue at about the same rate as presently occurs.

Water Quality: The septic system at Jackson Road would continue to be operated. The system complies with all county requirements and would not affect water quality. The new Mile High facility would not increase impacts to sedimentation or fecal coliform because the site is not near surface water and the facility would meet BMPs.

The effects of trail use on sedimentation would continue at about the same rate as presently occurs. The continued use by pack station animals would generate more sediment than under Alternative 1. Use trail NED15 would be monitored to determine whether it affects beneficial uses. (NED15) or meadow function (NED25).

The eleven designated campsites were selected and designed to meet BMPs for water quality protection. The changes that would be made at campsites are shown in Table 3.38.

Fecal coliform contamination could occur in the nine meadows that would be approved for grazing by pack stock (Bare Island, Biledo, Buffin, Dutchman Lake, Grizzly Creek, Tin Can, Upper Goat, Upper Iron Creek, and Soquel meadows). The other meadows were either not yet assessed or were found unsuitable for commercial pack stock grazing. Except for Dutchman Lake, these areas are also grazed by cattle. Compaction, sod fragmentation, stream channel disturbance, and fecal coliform contamination would increase slightly in Buffin, Dutchman Lake, Grizzly Creek, and Upper Goat meadows, because they have not been grazed by packstock in the past. These effects would be maintained at levels similar to the existing condition in the other meadows, which have been grazed in the past. Grazing standards and guidelines would be met by the combined cattle and pack stock use, or else allocated stock nights or season of use would be modified so that the standards are met.

Hydrology and Geomorphology: Impacts to a meadow caused by the use of NED25, which accesses Pike Camp, would continue because NED25 would be an approved use trail. This trail would be monitored to determine whether it affects meadow function. Pike Camp Cabin is prohibited for overnight use (Table 2.23), so the use of this trail would probably decrease.

Grazing in 10 meadows would increase the risk of impacts to hydrology and geomorphology. However, grazing management, including on-dates based on range readiness, use allocations, utilization standards, streambank disturbance standards, and protection of wet areas would limit the amount of disturbance and identify areas where changes in management are needed in order to prevent resource damage from exceeding standards and guidelines and prevent impacts to hydrology and geomorphology.

RCOs: Although no grazing would occur in Quartz Meadow Complex, RCO attainment would not be affected because the stream channel instability is not attributable to previous pack stock use.

Grazing in Biledo, Buffin, and Tin Can meadows would also not affect RCO attainment, but prohibiting the stock camp at the edge of Tin Can Meadow and relocating the camp at Biledo would improve RCO consistency by removing a use with an observed effect to the soil quality (compaction) and possibly the hydrologic function of these meadows.

CWEs: NED contains at least a portion of 48 subwatersheds in four HUC6 watersheds. As explained in the Cumulative Effects Overview, the contribution of pack station operations at the subwatershed scale is a maximum of 0.2% ERA, which is at most a contribution of 1/200 of the lower TOC. As the scale of assessment is expanded, the contribution diminishes even more. Most of the operations occur in one HUC6 watershed (White Chief). The town of Fish Camp is also in this watershed. Recent vegetation management, including thinning and a timber sale, have occurred in the AU in this watershed. Almost the entire AU contains active cattle grazing allotments. The cumulative effects of the roads, vegetation management activities, cattle grazing, urban areas, and recreation that occurs in each of these watersheds far outweigh the contribution of the pack station operations.

Alternative 3

Direct, Indirect, and Cumulative Effects

Soil Quality: Destination quotas would only apply to the MWSR within NED. Destination quota management would enable this destination zone to be managed based on on-site resource conditions. Stock overnighting areas would be explicitly specified (see Table 3.38), and therefore the impacts of that use would be more controlled. There would be a reduced risk of long-term impacts to soils resulting from camping at this specific site. Outside of this site, where commercial operators would not be permitted to camp or to drop clients, there could be a reduction in impacts related to camping (i.e., campsite size may decrease in some locations, ground cover would increase, soil compaction would decrease and soil quality would improve).

Trails NED22, NED23, and NED28 would be approved. Erosion of soils from NED22 would continue. NED23 and NED28 would have no noted effects on soil quality.

Water Quality: Adherence to BMPs at designated campsites in MWSR would protect soils and water bodies from impacts. There would be a reduced risk of long-term impacts to sedimentation resulting from camping at this specific site. Fecal coliform would be the same as under Alternative 2.

Pack stock use would continue to contribute to erosion of a stream crossing on NED23.

Hydrology and Geomorphology: NED25 would be prohibited, and the impacts to the hydrologic function of a small meadow that result from pack stock use of the trail would cease. All other meadows would have the same effects as under Alternative 2.

RCOs: Same as Alternative 2, except that prohibiting NED25 would improve RCO consistency by not authorizing a trail that has impacts to a meadow.

CLOVER (CLO)

Affected Environment

Several cabins, a water system, toilet facilities, corrals, roads, and tent cabins were assessed at the MPS Miller Meadow Headquarters. The main issue was one stock corral that spans Miller Creek, resulting in sediment and manure entering the stream during runoff events and contributing to sedimentation and fecal coliform in Miller Creek. This may be impairing the beneficial uses of Miller Creek.

The system trails used by MPS in this AU are also used by hikers and non-commercial stock. Nine trail segments used regularly by MPS were assessed. The condition of seven system trail segments ranged from good to fair (ratings of 1 and 2), with some trails (e.g., Norris Lake Trail, 24E25) identified as in need of heavy maintenance, repair, and possibly relocation (Hopson, 2004a). Degraded and eroding stream crossings, overly steep and eroding trails, poor trail location, and a lack or disrepair of water control structures (waterbars) were the reasons noted for water quality concerns. The use trails are almost exclusively used by MPS, with some private stock use occurring as well. The two use trail segments assessed were rated 0 – 1, with slight trail incision in meadows on day-ride trails the reason for the ratings of 1.

No campsites were identified as being used by commercial packers in this AU, so none were reviewed for BMP compliance.

Soldier Meadow was assessed for grazing suitability by the IDT. The fenced pasture at Soldier Meadow is intermittently maintained and grazed by cattle when the fence is down. This pasture has not been used by commercial pack stock, but has been used historically and recently as a recreational stock "tourist pasture" and in the recent past. It is a moderately productive, moist meadow at approximately 7,000 feet elevation. One perennial stream and one intermittent tributary flow through the meadow. Approximately 20% of the meadow is wet or wetland. Slight soil compaction was present throughout most of the meadow, and a small headcut was located on the perennial stream in the center of the meadow. The system was rated at PFC. RCOs are being met. The ID team found Soldier Meadow suitable for grazing, given that range readiness guidelines are implemented.

Environmental Consequences

Alternative 1

Direct Effect and Indirect Effects

Soil Quality: The 17 acres of soils at the MPS headquarters would eventually recover. Soil erosion on the site would also decrease.

Effects from confined pack stock use in Soldier Meadow, such as localized soil compaction, vegetation trampling and utilization would not occur in the 9 acre holding area in Soldier Meadow. Soil quality would be unchanged from existing condition, because the area has not been recently used by pack stock.

Water Quality: Removal of the corral on Miller Creek would improve water quality by removing this source of sediment and manure. Stream sedimentation and fecal coliform would decrease, and beneficial uses would be protected. The new corral would be monitored and additional protection measures would be designed if necessary to ensure that water quality is protected (see Monitoring Plan).

The contribution of commercial pack stock to erosion on the Norris Lake Trail (24E25) and other trails would cease. The trails section indicates that the removal of commercial pack stock would probably not result in less need for maintenance of most system trails in this AU. This means that sedimentation is not expected to decrease significantly on most system trails as a result of this alternative. Sedimentation resulting from trail erosion would remain about the same in most areas, and would decrease over time in streams with crossings near the eroding sections of the Norris Lake Trail. Very little other use occurs on use trails, and these would probably naturalize over time.

Hydrology and Geomorphology: Hydrology and geomorphology in Soldier Meadow would be unaffected by this alternative because there would be no change from the existing condition (this meadow is not currently grazed by commercial pack stock).

RCOs: RCOs are met in Soldier Meadow, and would not change under this alternative.

Cumulative Effects
In the long-term, erosion from the Norris Lake Trail would probably decrease after commercial pack stock use is discontinued and the trail is maintained. Most other system trails would remain in about the same condition. The incremental decrease in sedimentation in Jackass and Norris Creeks may be detectable near the locations where the Norris Lake Trail crosses these streams, but would not be detectable downstream.

Soldier Meadow would not be grazed by commercial pack stock, but it is likely that commercial cattle grazing would continue, or the meadow would be used by the Backcountry Horsemen as it has in the past. The cumulative effects to soil quality, water quality, and geomorphology in the meadow would be the same as the existing condition.

Alternative 2

Direct, Indirect, and Cumulative Effects
Soil Quality: Compaction of the 17 acres Miller Meadow Headquarters would continue. The effects to soils due to existing erosion on trails, especially the Norris Lake Trail (24E25), would continue. The majority of the erosion is due to the location of the trail and need for trail maintenance / reconstruction, and is not a result of this alternative.

Depending upon the amount of use, grazing in Soldier Meadow could increase vegetation utilization, trampling, and soil compaction relative to the existing condition. Resource protection criteria, including grazing utilization standards and early season on-dates, would minimize the effects of pack stock grazing in Soldier Meadow.

Water Quality: BMP compliance would be achieved by relocating the corral at Miller Meadow Headquarters to provide a stream buffer, which would stop the existing sedimentation and fecal coliform contributions to Miller Creek, and would substantially reduce possible off-site water quality impacts from sediment and manure entering the stream.

The effects to water quality observed due to existing erosion on trails, especially from the Norris Lake trail, would continue.

Fecal coliform in Soldier Meadow, and the risk of fecal coliform entering the stream, would increase. However, this would not result in impairment of beneficial uses of the unnamed creek in Soldier Meadow.

Because the corral at the MPS Headquarters concentrates animal use while grazing the meadow is a more dispersed use, buffering the corral is expected to reduce impacts to sedimentation and fecal coliform more than grazing in the meadow is expected to increase them, so the net effect would be a reduction of sediment and fecal coliform in streams relative to the existing condition. There would still be greater sediment and fecal coliform contributions than under the No Action alternative.

Hydrology and Geomorphology: Grazing in Soldier Meadow would increase the risk of impacts to hydrology and geomorphology. However, grazing management, including on-dates based on range readiness, use allocations, utilization standards, streambank disturbance standards, and protection of wet areas would limit the amount of disturbance and identify areas where changes in management are needed in order to prevent resource damage from exceeding standards and guidelines and prevent impacts to hydrology and geomorphology.

RCOs: Grazing management in Soldier Meadow would ensure that RCOs continue to be met.

CWEs: CLO contains at least a portion of 34 subwatersheds in five HUC6 watersheds. As explained in the Cumulative Effects Overview, the contribution of pack station operations at the subwatershed scale is a maximum of 0.2% ERA, which is at most a contribution of 1/200 of the lower TOC. As the scale of assessment is expanded, the contribution diminishes even more. Almost the entire AU overlaps with active cattle grazing allotments. The AU also contains several trailheads, trails, developed campgrounds, and designated OHV routes. The cumulative effects of the roads, vegetation management activities, cattle grazing, and recreation that occurs in each of these watersheds far outweigh the contribution of the pack station operations.

The majority of CLO lies within the Granite Creek watershed, downstream of where the 2005 Pack Stock Management EIS concluded that CWEs may be occurring. These effects were attributed to historic and recent cattle grazing, with little contribution from commercial pack stock. That analysis concluded that implementation of the selected alternative would not change the potential for CWEs in this watershed because the contribution from pack stock management was much smaller than the contribution from cattle grazing.

Alternative 3

Destination quotas would not apply in the CLO AU and approved trails would be the same as under the proposed action, so the effects to soils, water quality and hydrology in this AU are the same as under Alternative 2.

EDISON (EDI)

Affected Environment

Two pack station facilities, the HSPS main pack station and the D&F Edison spike station, were reviewed in the EDI AU. They had no notable water quality, hydrology or soils concerns, including the existing water systems at both facilities and the gasoline storage tanks at HSPS.

The system trails used by commercial pack stock in this AU are heavily used by hikers, moderately used by HSPS, and lightly used by non-commercial pack stock. Use trails are almost entirely used by commercial pack stock. The Trails section notes that cattle in the Mono Allotment cause the most significant impacts to trails in this AU. Three system and three use trails were assessed. System trail conditions varied from good to fair with lack of maintenance and erosion at stream crossings the primary causes of potential water quality impacts. There were only minor impacts on trail segments located in this AU.

The worst non-wilderness trail rating was for the Warm Creek trail (27E46), which was rated a 3 on a scale of 0 to 5 due to erosion into Warm Creek at the trail crossing. Use trail EDI02 was incised through an unnamed meadow. Although it was not determined during the field assessment, this trail may be actively eroding and affecting the hydrology of the meadow.

No campsites in this AU were identified as being used by commercial packers, so none were reviewed for BMP compliance for this analysis. No grazing areas are proposed in this AU.

FERC relicensing will affect hydroelectric power production at Lake Edison, including possible specification of riparian maintenance flow releases from the lake.

Environmental Consequences

Alternative 1

Direct Effect and Indirect Effects

Soil Quality: Cessation of commercial pack stock operations at the two facilities would result in recovery of 8 acres of soils and the decrease of any erosion from these sites. The Trails section notes that trail stability would probably not increase in this AU as a result of the removal of commercial pack stock – therefore, soil erosion would probably also not change, except on the High Sierra Pack Station Trail (a short system trail between the HSPS Main Pack Station and 28E27), which is used almost exclusively by commercial stock. Soil erosion and puddling on use trails, especially EDI02, would decrease because the trampling and soil displacement caused by commercial pack stock would cease. The conditions on the Warm Lake Trail are not likely to change much from the existing condition, because this is not one of the trails primarily used by the pack stations.

Water Quality: The effects to sedimentation and fecal coliform in streams would not be detectable because these sites both currently meet BMPs and show no impacts to water quality. Because soil erosion from system trails would not change, sedimentation would not be decreased. On use trails, sedimentation would decrease because the soil displacement caused by commercial pack stock would cease.

Hydrology and Geomorphology: The impact of EDI02 on meadow function would persist.

RCOs: There are no grazing areas to consider in this AU. However, stopping use of EDI02 would improve RCO consistency (even though the impacts to the meadow would persist until the trail is rehabilitated).

Cumulative Effects

Erosion in the AU would decrease slightly due to stabilization of the EDI02 use trail and the High Sierra Pack Station Trail, but impacts from other users and commercial cattle on trails would continue. The erosion and sedimentation from land uses in this AU would be reduced by a very small percentage of the total. Specification of riparian maintenance flow releases from Lake Edison would benefit hydrology, geomorphology, and RCO attainment in riparian areas downstream of the dam.

Alternative 2

Direct and Indirect Effects

Soil Quality: Continued use of the two facilities in this AU would maintain compaction on 8 acres of soils. No change in impacts from facilities would occur under this alternative.

Water Quality: Continued use of the facilities would not impact water quality, because these sites meet BMPs and have no observed impacts to water quality.

The current sedimentation and fecal coliform contributions resulting from trails would continue. Field assessments and the Trails analysis both conclude that erosion resulting

from the commercial pack stock is minor, although some erosion at stream crossings occurs. Manure on trails would continue to pose a risk of introducing fecal coliform to streams. The impacts would be greater than under Alternative 1.

Hydrology and Geomorphology: Use trail EDI02 would continue to erode and affect the hydrology of a small meadow.

RCOs: A minor departure in RCOs would persist due to the impacts of EDI02 on a small meadow.

CWEs: EDI contains at least a portion of 18 subwatersheds in three HUC6 watersheds. As explained in the Cumulative Effects Overview, the contribution of pack station operations at the subwatershed scale is a maximum of 0.2% ERA, which is at most a contribution of 1/200 of the lower TOC. As the scale of assessment is expanded, the contribution diminishes even more. Most of the operations occur in the Edison Reservoir HUC6 watershed. The cumulative effects of the roads, cattle grazing, SCE activities related to hydropower generation, and developed and dispersed recreation that occurs at the Mono Creek and Vermillion Campgrounds, the Onion Spring OHV Route, and on trails in this watershed far outweigh the contribution of the pack station operations. Specification of riparian maintenance flow releases from Lake Edison would benefit hydrology, geomorphology, and RCO attainment in riparian areas downstream of the dam.

The majority of EDI lies within the Edison Reservoir HUC6, downstream of where the 2005 Pack Stock Management EIS concluded that CWEs may be occurring. These effects were attributed to historic and recent cattle grazing, with little contribution from commercial pack stock. That analysis concluded that implementation of the selected alternative would not change the potential for CWEs in this watershed because the contribution from pack stock management was much smaller than the contribution from cattle grazing.

Alternative 3

Destination quotas would not apply in the EDI AU and approved trails would be the same as under the proposed action, so the effects to soils, water quality and hydrology in this AU are the same as under Alternative 2.

CHINQUAPIN (CHQ)

Affected Environment

No facilities, use trails, or grazing areas, are located in CHQ. HSPS and D&F use 3 miles (1 ac) of system trails, but their primary use in this AU is to drive their stock to and from their facilities on roads at the beginning and end of their operating season. The IDT did not assess roads or trails, so site-specific information about their existing condition with respect to water quality is lacking. The risk associated with this data gap is probably low due to the low number of miles of trails used, the minimal impacts associated with stock walking on an existing road, and the infrequent use of both roads and trails. The

Trails section notes that these trails are currently stable, so erosion and sedimentation are probably not concerns.

Environmental Consequences

Because there is no site-specific information within this AU, the Environmental Consequences Overview for each Alternative provides the greatest level of detail for the effects related to the use of the trails and roads in this AU.

FLORENCE (FLO)

Affected Environment

Both pack station facilities in this AU were assessed. At the HSPS spike station near the north end of Florence Lake, a hitching rail was located adjacent to a stream and was causing sedimentation and fecal contamination impacts. The rest of the pack station had no hydrology, water quality, or soils concerns, including the existing water system. At the Lost Valley spike station, located adjacent to the south end of Florence Lake, no hydrology, water quality or soils concerns were noted.

MTR operates the Florence Lake Resort in this AU, which is permitted to operate two gasoline pumps with 1000 gallon storage tanks. These tanks are above ground and have a secondary containment system to ensure that no leakage leaves the site and reaches Florence Lake. MTR has an approved Spill Prevention Containment and Control (SPCC) Plan in place.

HSPS, LVPS, and other pack stations, including D&F and MTR, use the trail system in the FLO AU to access wilderness destinations. The trails section notes that the Florence Lake Trail (27E81) receives the heaviest commercial pack stock use, but is stable. The trail with the most erosion problems is the Crater Lake Trail (27E05), but the primary factors causing the erosion are steep terrain and lack of maintenance, not pack stock use. Short segments of three trails were assessed within the FLO AU, and no trail concerns relative to soils, hydrology, or water quality were observed.
No campsites were reviewed for BMP compliance within this AU because none are used by commercial packers.

HSPS uses the Jackass Meadow complex, partly in this AU and partly in the AA/JM (Post Corral AU), for grazing. The entire meadow complex was analyzed in the 2005 Pack Stock Management EIS. That analysis is incorporated by reference.

FERC relicensing will affect hydroelectric power production at Florence Lake, including possible specification of riparian maintenance flow releases from Florence Lake and the removal of the Crater Diversion (located in AA/JM, but flowing into FLO).

Environmental Consequences

Alternative 1

Direct Effect and Indirect Effects

Soil Quality: Discontinuing use of the two spike stations and the Florence Lake Resort would allow approximately 10 acres of soils at those sites to recover, and soil erosion on these sites would decrease.

Discontinuing commercial pack stock use of system trails would probably not reduce erosion since the most heavily used trail is currently stable. The Crater Lake Trail (27E05) would remain unstable until the trail is rehabilitated. Two use trails would naturalize over time once commercial use is discontinued, which would reduce the risk of erosion from these trails, although they are not causing problems in their existing condition.

Water Quality: The water quality impacts caused by the proximity of the hitching rail at the HSPS station to a creek would cease. A reduction in both sedimentation and fecal coliform would occur relative to the existing condition.

The risk of sedimentation from two use trails that would naturalize over time would be reduced, although they are not contributing to sedimentation in their existing condition.

Hydrology and Geomorphology and RCOs: Because there are no grazing areas in this AU, and no meadows that are affected by other pack station uses, these analysis elements do not have site-specific application within this AU.

Cumulative Effects
In this AU, the total decrease in erosion compared to the existing condition would be minor, because the many other uses including roads, the Jackass Campground, the Florence Lake picnic area, the Hooper OHV Route, and major wilderness trailheads at Florence Lake would continue. Cumulative sedimentation would be the same as in the existing condition. Riparian maintenance flow releases from Florence Lake would benefit hydrology, geomorphology, and RCO attainment in riparian areas downstream of the dam. The effects of removing of the Crater Creek diversion have not yet been fully assessed through the FERC relicensing process, but generally would restore more natural hydrology to the affected areas.

Alternative 2

Direct, Indirect, and Cumulative Effects
Soil Quality: Soil compaction would be maintained on approximately 10 acres, including the Florence Lake Resort and two pack station facilities.

Erosion on trails would be minor in this AU; only 0.5 acres of trails are used, and these trails would remain stable. The condition of the Crater Lake Trail (27E05) would be similar to under Alternative 1, since it would be rarely used by commercial pack stock.

Water Quality: BMP compliance would be achieved at the HSPS Florence Lake Spike Station by relocating the hitching rail away from the creek. This would reduce sedimentation and fecal coliform impacts of the operation relative to the existing condition.

Sedimentation resulting from commercial pack stock use of trails is minor in this AU; only 0.5 acres of trails are used, and these trails would remain stable. The condition of the Crater Lake Trail would be similar to under Alternative 1.

The Florence Lake Resort would continue to operate gasoline pumps near Florence Lake, which carries a low risk of gasoline contamination of surface water. The secondary containment system and an approved SPCC Plan mitigate this risk.

Hydrology and Geomorphology and RCOs: Because there are no grazing areas in this AU, and no meadows that are affected by other pack station uses, these analysis elements do not have site-specific application within this AU.

CWEs: FLO contains at least a portion of 15 subwatersheds contained in one HUC6 watershed (Florence Reservoir). As explained in the Cumulative Effects Overview, the contribution of pack station operations at the subwatershed scale is a maximum of 0.2% ERA, which is at most a contribution of 1/200 of the lower TOC. As the scale of assessment is expanded, the contribution diminishes even more. The cumulative effects of the roads, vegetation management activities, cattle grazing, and recreation (including OHV routes) that occurs in this watershed far outweighs the contribution of the pack station operations. Riparian maintenance flow releases from Florence Lake would benefit hydrology, geomorphology, and RCO attainment in riparian areas downstream of the dam, including Jackass Meadow. (Cumulative effects in Jackass Meadow were assessed in the 2005 Pack Stock Management EIS.) The effects of removing of the Crater Creek diversion have not yet been fully assessed, but generally would restore more natural hydrology to the areas that have been modified by the diversion for over 70 years.

Alternative 3

Destination quotas would not apply in the FLO AU and approved trails and facilities would be the same as under the proposed action, so the effects to soils, water quality and hydrology in this AU are the same as under Alternative 2.

KAISER (KAI)

Affected Environment

No facilities are located in this wilderness AU.

D&F primarily uses the California Riding and Hiking Trail (26E30) and the Twin Lakes Loop (26E62) system trails, and use trails that access Twin Lakes (KAI01) and Walling Lake (KAI02). Part or all of six system trails and two use trails were assessed in the field: 24E03, 26E31, 26E06, 27E41, 25E58, and 26E62 system trails and KAI101 and KAI 102 use trails. Overall, trails were in good to fair condition. Three trails, including the Twin Lakes Loop, a portion of the Kaiser Loop, and KAI02 were rated '3' for trail widening and incision, multiple trails, and sediment entering streams (except KAI02 which does not affect streams). The limited trail maintenance combined with heavy pack

stock and hiker use has resulted in notable soil erosion and sedimentation in some locations. Impacts to meadows were also observed.

Four campsites were assessed for BMP implementation and effectiveness. Of these sites, three (75%) were located too close to water, per wilderness plan requirements. One site had evidence of sediment reaching the adjacent lake, however impacts were slight and no impairment to beneficial uses was apparent. Another site was contributing a moderate amount of sediment to the adjacent stream. As explained in the Methodology section: these sites were not randomly selected and therefore cannot be interpreted as representing unsampled sites; and may not have been used by commercial operators or their clients and therefore cannot be interpreted as an objective impact of pack station use.

Two meadows near Nellie Lake were assessed for grazing suitability. At NE Nellie Lake Meadow, approximately 25% of the meadow was wet to moist and in good condition. The other 75% of the meadow was dry and in fair condition. Soil compaction was observed on up to 15% of the meadow, and sod fragmentation on about 5% of the area was distributed throughout the meadow. A small headcut and slight hydrologic alteration were noted. The conditions at the meadow meet RCOs. The soft moist soils observed during this early October field visit suggest that early or mid season grazing could cause permanent damage to vegetation and soils. Sensitive springs and wet areas would be damaged from grazing prior to drying of soils. This meadow was approved by the IDT for incidental late-season commercial pack stock grazing, with protection of wet areas.

Nellie Lake Meadow had evidence of horse and cattle trampling damage to moist soils. Compaction was noted on up to 15% of the meadow, and sod fragmentation occurred on less than 5%. Slight hydrologic alteration was noted. Horse trampling appears to result from trailing between an adjacent campsite and Nellie Lake for watering. The conditions at the meadow meet RCOs. The meadow is relatively small, immediately adjacent to Nellie Lake, and easily accessible from an adjacent campsite. This meadow was determined to be not suitable for commercial pack stock grazing.

The Baseline CWE Assessment for the Wilderness AUs (in the project file) identified the Huntington Lake HUC6 as over its Threshold of Concern (TOC) for a Cumulative Watershed Effects response. Approximately 10,750 acres (or roughly 50% of the AU) that is south of Kaiser Ridge is located in this HUC. The field assessments were concentrated mostly in this area.

Environmental Consequences

Alternative 1

Direct Effect and Indirect Effects

Soil Quality: Trail stability would increase slightly and erosion would decrease slightly on the system trails that receive moderate use by D&F. The erosion on use trail KAI02, which is used almost exclusively by commercial pack stock, would be reduced under this alternative. Because there are currently no erosion problems on KAI01, no improvement is expected from the removal of commercial pack stock use.

No trampling or soil compaction would occur in either of the assessed meadows as a result of this alternative.

There would be no soil compaction resulting from cross country travel of commercial pack stock in the Kaiser Wilderness.

Water Quality: The slight decrease in erosion would slightly decrease sedimentation.

Manure would no longer be produced by commercial pack stock, therefore the total amount of fecal coliform in the area would decrease.

Hydrology and Geomorphology: Commercial pack stock would not be present in either assessed meadow, which would result in a reduced potential for disturbance to springs or impacts to meadow function.

RCOs: There would be no change in RCOs, which are currently being met in the meadows in this AU.

Cumulative Effects
The trail where reductions in use are expected to produce the greatest benefits (KAI02) is not located in the Huntington Lake HUC, and does not have impacts to water quality because the erosion from the trail does not reach surface water. The slight decreases in erosion and sedimentation that would occur in some locations under this alternative would not result in a detectable change in soil or water quality at any scale larger than the affected sites, because heavy hiker use and private pack stock use would continue on the trails, and trail maintenance would continue to occur on a schedule similar to present. Fecal coliform would decrease in the area, but sources other than commercial pack stock, including private stock, wildlife, and humans, would still be present.
Because this AU is grazed by cattle and previous pack station use has been incidental (no reported use between 2001-2003), meadow condition, including soil quality, erosion, sedimentation, fecal coliform, and hydrologic condition, will likely remain the same as the existing condition.

Removal of commercial pack stock use from trails in the Huntington Lake HUC portion of the AU would not affect the risk of a Cumulative Watershed Effects (CWE) response. As shown in Table 3.32, most of the disturbance in this HUC occurs in meadows (an estimated 490 acres), with disturbance from trails (17 acres) and campsites (3.6 acres) trailing far behind. This alternative has a limited potential to slightly improve the condition of 2 acres of meadows, and an even more limited potential to decrease disturbance from trails. Given the reasons that CWEs are occurring, this alternative would not result in reduced CWEs.

Alternative 2

Direct, Indirect, and Cumulative Effects
Soil Quality: Trail condition would continue to be the same as the existing condition. Areas where erosion and sedimentation into streams are currently occurring will continue

at about the same rate. Commercial pack stock use will not be permitted on KAI01, but since there are currently no erosion impacts, no change in trail erosion is expected.

NE Nellie Lake Meadow would experience a slight increase in direct impacts to soil quality due to additional soil compaction and sod fragmentation. Grazing would not occur in this meadow until late season due to Yosemite toad concerns, so the soil in the meadow is likely to be relatively dry compared to other times of the season, which will limit compaction and trampling impacts.

The proposed action would result in direct impacts to soil compaction and soil disturbance in the Kaiser Wilderness due to the allowance of cross country travel. The degree or amount of soil compaction and soil disturbance is not expected to be significant because only a small amount of cross country travel currently occurs, and the level is not expected to increase as a result of the proposed action.

Water quality: Manure would continue to be produced in the area at a rate similar to the existing condition. Fecal coliform would be introduced to surface water at stream crossings.

Trampling of the spring in NE Nellie Lake Meadow could increase sedimentation, but implementing grazing management standards and guidelines would mitigate this risk.

Hydrology and Geomorphology: If trampling in NE Nellie Lake Meadow is severe, it could activate the existing headcut and affect geomorphology and hydrologic function. Unless soil compaction and sod fragmentation increase in severity and extent, there will be no impact to hydrologic function. The level of use approved in NE Nellie Lake Meadow (16 stock nights annually) and other stipulations applied (Table 2.22) would avoid the potential for activating the existing headcut in the meadow and would avoid effects to geomorphology and hydrologic function.

RCOs: Monitoring and adaptive management as outlined in the Packstock Management Guide (Appendix G of the 2001 Wilderness Plan) would ensure that standards and guidelines, including RCOs, continue to be met in NE Nellie Lake Meadow.

CWEs: KAI contains at least a portion of 32 subwatersheds in four HUC6 watersheds. Continued commercial pack stock use of trails in the Huntington Lake HUC portion of the AU would not affect the risk of a Cumulative Watershed Effects (CWE) response. As shown in Table 3.32, most of the disturbance in this HUC occurs in meadows (an estimated 490 ac), with disturbance from trails (17 ac) and campsites (3.6 ac) trailing far behind. This alternative authorizes limited grazing in approximately 1 acre of meadow. The contribution of pack stock to sedimentation resulting from use of system trails would continue, but the incremental contribution is small. Given the reasons that CWE are occurring, this alternative would not result in increased CWE.

Alternative 3

Direct, Indirect, and Cumulative Effects

Soil Quality: Destination quota management would enable the 6 destination zones in the KAI AU to be managed based on on-site resource conditions. Stock overnighting areas would be explicitly specified and permitted in only one destination zone, and therefore the impacts of that use would be more controlled. There would be a reduced risk of long-term impacts to soils and sedimentation resulting from camping at specific sites within destination zones due to the monitoring and adaptive management that would occur.

Outside of the destination zones, where commercial operators would not be permitted to camp or to drop clients, there could be a reduction in impacts related to camping (i.e., campsite size may decrease in some locations, ground cover would increase, soil compaction would decrease and soil quality would improve).

Water Quality: Campsites would be designated that meet BMPs and that best protect water bodies from impacts.

Since trail conditions dominate the effects to sedimentation, and are essentially the same as Alternative 2, there would be no reduction on trails and just slightly less sedimentation overall (due to the reduction from campsites) than under Alternative 2.

Fecal coliform would be the same as under Alternative 2.

Hydrology and Geomorphology, RCOs, and CWEs: Same as under Alternative 2.

EAST HUNTINGTON (HNE)

Affected Environment

Two pack station facilities were field reviewed in this AU. The D&F Main Pack Station facility is used to hold stock, as a meeting location for the public, as a start point for day rides and to access Kaiser Wilderness, and overnight use. A nearby perennial spring provides drinking water. The D&F Main Pack Station is bordered by a perennial tributary of Deer Creek to the west, and a wet seep/meadow to the south. This facility is located in the Streamside Management Zone (USDA Forest Service, 1991) and Riparian Conservation Area (USDA Forest Service, 2004) of Deer Creek. Erosion from the facility was impacting the Deer Creek tributary and a wet meadow. Runoff from the roof of the shower room was adding sediment into the adjacent stream. The stock corral is well situated and does not pose a water quality threat.

The Badger Spike Station is used to hold stock for access into the Dinkey Lakes Wilderness. The site consists of a couple of buildings and a stock corral. No overnight use of the facility is available. While the facility is located on a ridge and away from streams, there were large areas of erosion originating from the corral and the trail leading from the spike station. Sediment originating from the corral was transported over ¼ mile down a steep hill and entered Midge Creek, west of the spike station. A large, rare

thunderstorm event caused the erosion observed. However, erosion from the spike station was significantly greater than that observed in adjacent forested areas.

No campsites were reviewed in this AU because none are used by commercial pack stations.

The Potter Pass Trail (26E35), the Potter Pass Cutoff Trail (26E39) and California Riding and Hiking Trail (24E03) are the primary system trails used by D&F in this AU. They also receive light to moderate private pack stock use. The Potter Pass Trail and Trail 26E64 cross Deer Creek once and Potter Creek twice between the D&F Main Pack Station and the Kaiser Wilderness boundary at Potter Pass. Field observations in 2004 concluded that beneficial uses of Potter Creek were likely being impaired due to erosion and sedimentation from these trails and stream crossings. The overall trail rating was a 4, primarily due to sedimentation impacts into Potter Creek. In 2006, the High Sierra Ranger District Watershed Crew installed over 100 waterbars on the lower portion of this trail, where erosion had the most impact on water quality. Trail erosion will be reduced, and beneficial uses better protected, by this maintenance work. The section of the California Riding and Hiking Trail that is used by commercial pack stock is in stable condition.

Use trails in this AU are frequently used by D&F, and rarely by other users. Two use trails were field reviewed (HNE01 and HNE02). The trail is a loop off of the Potter Pass Trail and used by D&F to as a day ride from the pack station headquarters. The trails had some slight to moderate erosion that could be easily repaired. There were no stream crossings. The overall trail rating was a 2. Three use trails located between the main pack station facility and the Badger Flat spike camp were not reviewed in the field. The Trails section characterizes these trails as inherently more stable than the use trails in the Potter Creek area, and less visible to other users.

At the beginning of the season, HSPS drives their stock from Badger Flat to Portal in and to the northeast of this AU, using the Kaiser Pass Road and an established stock driveway that is also open to 4WD vehicles.

There are no commercial pack stock grazing areas proposed in this AU.

Environmental Consequences

Alternative 1

Direct Effect and Indirect Effects

Soil Quality: Discontinuing use of the D&F Main Pack Station and the Badger Spike Station facilities would allow 7 acres of soils to eventually recover. Soil erosion on these sites would decrease.

The Potter Pass Trail (26E35) is the only system trail that would see an increase in stability due to removal of pack stock, since it is the only system trail with erosion attributed to commercial stock use. Use trails would become more stable and erode less.

HNE03 and HNE04 would probably naturalize once commercial pack stock use is removed.

Water Quality: Sedimentation impacts to water quality resulting from facilities would be reduced, particularly in Deer Creek. The risk of sedimentation into Midge Creek during large thunderstorms would also decrease.

Sedimentation from the Potter Pass Trail would decrease as trail stability improves. Sedimentation caused by erosion on use trails would decrease as these trails stabilize over time.

Hydrology and Geomorphology and RCOs: Because there are no grazing areas in this AU, and no meadows that are affected by other pack station uses, these analysis elements do not have site-specific application within this AU.

Cumulative Effects
Discontinuing use of the D&F Main Pack Station may result in a detectable decrease in sedimentation in Deer Creek in the vicinity of the facility. The Badger Spike Station is an episodic contributor of sediment rather than a chronic contributor (in other words, sedimentation occurs during large storm events but not every season), so removal of this facility will have less of a benefit to water quality.

Fecal coliform would be reduced in the AU. Other sources such as private pack stock, cattle, wildlife, pets, and humans would continue to use the area, so some fecal coliform would still occur.

The recent trail maintenance on the Potter Pass Trail (26E35) is expected to greatly reduce erosion and water quality impacts from this trail, so removing commercial pack stock under this alternative would reduce erosion and water quality impacts only slightly more than this trail work will alone. Other sediment sources including other trails, roads, residences, and the Kinnikinnick and Deer Creek Campgrounds, would make the reduction difficult to detect downstream.

Alternative 2

Direct, Indirect, and Cumulative Effects
Soil Quality: Soils would remain compacted at 7 acres of facilities.

The Potter Pass Trail would continue to be used by D&F, but the potential for erosion and sedimentation have been reduced by recent trail maintenance that was performed since this trail was assessed.

Water Quality: BMP compliance at the two pack station facilities (D&F Main Pack Station and Badger Flat Spike Camp) would be achieved by applying erosion control measures at these facilities, as specified in design measures included in the proposed action. The proximity of the D&F Main Pack Station to Deer Creek would continue to pose some water quality threat to the stream, but sedimentation would be greatly reduced.

There was no concern for fecal coliform identified at either facility, and under this alternative there would be no change in fecal coliform contributions.

Hydrology and Geomorphology and RCOs: Because there are no grazing areas in this AU, and no meadows that are affected by other pack station uses, these analysis elements do not have site-specific application within this AU.

CWEs: HNE contains at least a portion of 11 subwatersheds in the Huntington Lake HUC6 watershed. As explained in the Cumulative Effects Overview, the contribution of pack station operations at the subwatershed scale is a maximum of 0.2% ERA, which is at most a contribution of 1/200 of the lower TOC. As the scale of assessment is expanded, the contribution diminishes even more. The Huntington Lake watershed also contains a portion of KAI, and most of HNW and COO, as well as roads, OHV routes, recent vegetation management projects, active cattle grazing allotments, recreation residences, organizational camps, developed campgrounds, and private property. Runoff from the portion of KAI in this HUC6 flows through HNE and then into Huntington Lake. HNW and COO have different drainage networks, so that the runoff from these AUs converges in Huntington Lake. The lake acts as a buffer for sediment and fecal coliform that are delivered to it, and no upstream effects are propagated downstream of the dam. Even upstream of Huntington Lake, the cumulative effects of the roads, vegetation management activities, cattle grazing, developed areas, and recreation that occurs in this watershed far outweighs the contribution of the pack station operations.

Alternative 3

Direct, Indirect, and Cumulative Effects

Destination quotas would not apply in the HNE AU and approved trails would be the same as under the proposed action, so the effects to soils, water quality and hydrology in this AU are essentially the same as under the proposed action.

WEST HUNTINGTON (HNW)

Affected Environment

No facilities, use trails, or grazing areas are located in HNW.

The Kaiser Loop Trail (26E06), and the trail along the shore of Huntington Lake (25E43) are the areas used by commercial pack stock in this AU. The Kaiser Loop Trail (the southern portion of the loop, outside of the Kaiser Wilderness) is heavily used by hikers and moderately used by private stock and D&F. The portion of the trail in this AU was in good condition, but in some areas, general trail maintenance needs (water bar maintenance) and erosion at stream crossings were noted. Trail 25E43 is heavily used by hikers but private equestrian use is not permitted. The IDT did not assess 25E43, so site-specific information about the existing condition relative to soil and water is lacking.

Environmental Consequences

Because there is little site-specific information within this AU, the Environmental Consequences Overview for each Alternative provides the greatest level of detail available for the effects related to the use of the trails in this AU. However, because streams from KAI flow into this AU, an AU-specific assessment of the cumulative effects of Alternative 2 and Alternative 3 is described.

Cumulative Effects of Alternatives 2 and 3

HNW contains at least a portion of 14 subwatersheds in two HUC6 watersheds. As explained in the Cumulative Effects Overview, the contribution of pack station operations at the subwatershed scale is a maximum of 0.2% ERA, which is at most a contribution of 1/200 of the lower TOC. As the scale of assessment is expanded, the contribution diminishes even more. Most of the AU is in the Huntington Lake HUC6, and contains roads, OHV routes, recent vegetation management projects, an active cattle grazing allotment, and recreation residences. Runoff from the portion of KAI in this HUC6 flows through HNW and then into Huntington Lake. The lake acts as a buffer for sediment and fecal coliform that are delivered to it, and no upstream effects are propagated downstream. Even upstream of Huntington Lake, the cumulative effects of the roads, vegetation management activities, cattle grazing, developed areas, and recreation that occurs in this watershed far outweighs the contribution of the pack station operations in both this AU and in KAI.

COYOTE (COO)

Affected Environment

There are no facilities in this wilderness AU. The Dinkey Lakes Trail Management Plan applies to this AU.

D&F operates in this AU, primarily providing day rides on the California Riding and Hiking Trail (24E03) and use trail COO01, leading to the Dusy-Ershim OHV trail. They also provide some overnight services, especially during hunting season. The California Riding and Hiking Trail also receives heavy use from other recreationists.

The IDT did not assess campsites in this AU, so site-specific information about the existing condition is lacking. The IDT assessed four trails in this AU, and identified three of the four to be in stable condition. Only the Black Peak Trail (27E08) showed active erosion. The Trails section notes that trails in this AU are generally stable, with the exception of the Black Peak Trail (27E08) south of Rock Meadow.

Grazing use in Rock Meadow and Perkins Camp was requested, but this has not been assessed by the IDT and is not approved in any alternative.

This AU is located in the Huntington Lake HUC6, which was found in the Baseline CWE Assessment to be over its threshold of concern for a CWE response.

Environmental Consequences

Alternative 1

Direct Effect and Indirect Effects

Soil Quality: Removing commercial pack stock use would reduce traffic on a total of 5 acres of trails in the AU, including the California Riding and Hiking Trail and COO01. This would probably have no effect on sedimentation since these trails are not noted to have trail stability concerns. The Black Peak Trail would continue to be missing from the system, would not be maintained, and would continue to erode.

Removal of commercial pack stock from 241 acre Rock Meadow could result in a decrease in trampling impacts, improved soil quality, and decreased erosion from stream banks.

Water Quality: There would be a reduction in fecal coliform due to removal of commercial pack stock.

Several trails in COO are not on the current Trail Management Plan, and therefore will receive no maintenance. The Trails section notes that trails in COO are generally stable (with the exception of the Black Peak Trail). However, if no maintenance is done then over time they may develop impacts to water quality. The Black Peak Trail would continue to erode and impact water quality.

Removal of commercial pack stock from Rock Meadow in particular could result in decreased sedimentation.

Hydrology and Geomorphology: The removal of commercial pack stock grazing from Rock Meadow and Perkins Camp could result in improvements to stream and meadow function, although the degree of potential improvement is unknown because the existing condition of these areas has not been assessed.

RCOs: There would be no potential for commercial pack stock to contribute to not meeting RCOs.

Cumulative Effects

Because non-commercial recreation use is heavy in this area, and because the trails are relatively stable, removing commercial pack station use would not change the erosion on trails or their sedimentation contribution to CWEs. Cattle also create intermittent trails that may have impacts to water quality, which would continue under this alternative.

Recent commercial pack animal grazing has occurred in Rock Meadow and Perkins Camp, which have not been assessed by the IDT. Given that disturbance in meadows is the primary contributor to CWEs in the wilderness (Table 3.32 and Gott and Sanders 2006), removal of pack stock from these 246 acres of meadows could contribute to a reduction in cumulative impacts, specifically hydrologic alteration and sedimentation. However, commercial cattle grazing would continue to occur in these meadows, and could result in soil compaction and sod fragmentation that impact soil quality and

hydrologic function. Whether there would be a decrease and if so how much cannot be determined unless these meadows are assessed.

Alternative 2

Direct, Indirect, and Cumulative Effects

Soil and Water Quality: Commercial pack stock would use the California Riding and Hiking Trail, which according to the Trails section (3.1.3) has been relatively stable with this use, and would continue to be stable under this alternative. The total use would be the same as what has occurred recently and would result in similar pack stock impacts to water quality as reflected in the discussion of the Overview – Common to All Analysis Units – Affected Environment.

Use of COO01 would be prohibited, and it may naturalize as some trails in the area have from lack of use. Existing soil compaction on this trail would recover.

Three trails that are currently not classified for maintenance would be classified by the Dinkey Lakes Trail Management Plan. Their classification would range from TC1 to TC3 under this alternative. Although trails are assumed to be stable and not creating notable erosion and sedimentation impacts, adding Trail Classes would make it more likely that periodic maintenance would occur and would maintain stability and prevent erosion increases. Adding the Black Peak Trail (27E08) in partcular as a TC3 would make it more likely that the maintenance would occur on the segment south of Rock Meadow and erosion would be controlled.

Hydrology and Geomorphology: Commercial pack stock would not graze in Rock Meadow or Perkins Camp. The effects would be the same as Alternative 1, which are difficult to predict until the meadow is assessed.

RCOs: Pack stock would not graze in Rock Meadow or Perkins Camp. Because the status of RCOs has not been assessed in the meadows in COO, the potential effect on RCOs is unknown.

CWEs: COO contains at least a portion of 14 subwatersheds in the Huntington Lake HUC6 watershed. As shown in Table 3.32, most of the disturbance in this HUC occurs in meadows (an estimated 490 ac), with disturbance from trails (17 ac) and campsites (3.6 ac) trailing far behind. This alternative authorizes no grazing in this AU. The contribution of pack stock to sedimentation resulting from use of system trails would continue, but the incremental contribution is small. Given the reasons that CWE are occurring, this alternative would not result in increased CWE.

The Huntington Lake watershed also contains a portion of KAI, HNE, and most of HNW, as well as roads, OHV routes, recent vegetation management projects, active cattle grazing allotments, recreation residences, organizational camps, developed campgrounds, and private property. Runoff from COO does not flow through these other AUs, but converges in Huntington Lake. The lake acts as a buffer for sediment and fecal coliform that are delivered to it, and no upstream effects are propagated downstream of the dam.

Even upstream of Huntington Lake, the cumulative effects of the roads, vegetation management activities, cattle grazing, developed areas, and recreation that occurs in this watershed far outweighs the contribution of the pack station operations. Continued commercial pack stock use of trails in this AU would not affect the risk of a Cumulative Watershed Effects (CWE) response.

Alternative 3

Direct, Indirect, and Cumulative Effects

Soil Quality: Same as Alternative 2, except that destination zones at Perkins Camp and Rock Meadow would enable site-specific management of impacts to soils and water. Stock overnighting areas would be explicitly specified, and therefore the impacts of that use would be more controlled.

There would be a reduced risk of long-term impacts to soil quality resulting from camping at specific sites within destination zones. Outside of these areas, where commercial operators would not be permitted to camp or to drop clients, there could be a reduction in impacts related to camping (i.e., campsite size may decrease in some locations, in which case ground cover would increase, soil compaction would decrease and soil quality would improve).

The Black Peak Trail (27E08) would be added to the system as a TC2 rather than a TC3. Adding the trail at this lower TC would still be likely to result in maintenance work that would control the erosion, so the effect would be the same as Alternative 2. Use trail COO01 would be approved. This trail is not eroding and its condition would remain stable.

Water Quality: Same as Alternative 2, except that campsites would be designated that meet BMPs and that best protect soils and water bodies from impacts. There would be no increases in sedimentation or fecal coliform resulting from these camps.

Sedimentation form the Black Peak Trail would probably be reduced due to future maintenance. Pack stock use on COO01 would not affect sedimentation.
In this alternative, the Dinkey Lakes Trail Management Plan would remove some trails from the system and would lower the Trail Class of some other trails compared to Alternative 2. The trails that would be removed are naturalizing and do not receive much use, so discontinuing maintenance would allow them to completely naturalize. There would no effect to erosion or sedimentation compared to the existing condition, and a reduction compared to Alternative 2, which proposes to maintain trails that are not needed. Even a well-maintained trail produces some sediment, so reducing the total trail mileage in COO would result in less sediment. The trails whose classes would be lower in this alternative than in Alternative 2 would receive less frequent maintenance. It is unclear without assessing these trails whether these lower Trail Classes would result in increased erosion and sedimentation compared to Alternative 2.

Hydrology and Geomorphology, RCOs and CWEs: Same as under Alternative 2.

DINKEY LAKES (DIL)

Affected Environment

There are no facilities or commercial stock camps in this wilderness AU. The Dinkey Lakes Trail Management Plan applies to this AU.

D&F and CPO use DIL for occasional spot and dunnage trips. There are no commercial stock camps or grazing areas in this AU. The trails in this AU receive heavy hiker and light commercial and private equestrian use.

Five campsites were assessed for BMP implementation and effectiveness. Three of the evaluated sites (60%) were located too close to water. Evidence of sediment reaching a stream was found at one (20%) site. As explained in the Methodology section: these sites were not randomly selected and therefore cannot be interpreted as representing unsampled sites; and may not have been used by commercial operators or their clients and therefore cannot be interpreted as an impact of pack station use.

The Trails section notes that trails in this AU tend to be stable, with a notable exception along the Mystery Lake Trail (27E1) west of Swede Lake. The Dinkey Creek Trail and the Mystery Lake Trail (27E11) form a very popular day-hiking loop. These system trails were assessed, as were the portions of the Black Peak Trail (27E08) and Coyote Lake Trail (26E43) that are within this AU. Conditions on the Dinkey Lake Trail (27E07) were good overall, but multiple trails and eroding stream crossings are creating erosion and sedimentation. The Mystery Lake Trail was rated '3' for meadow impacts and sedimentation near Mystery and Swede Lakes. The Black Peak and Coyote Lake Trails were stable in this AU. Use trail DIL01 was also assessed, and rated a '3' due to meadow impacts.

Three meadows were assessed for grazing suitability within DIL AU, including Miner Camp Meadow, South Lake Meadow, and SE 1st Dinkey Lake Meadow. None of these meadows are currently grazed by commercial pack stations, but are likely used by private stock.

Miner Camp Meadow is approximately 28 acres, varying from dry to standing water. A perennial channel flows through the meadow. Meadow condition varied from good in the wetter portions to fair to poor in dry to moist areas. The wetter portion in the center meadow may be a fen. Compaction and sod fragmentation occurred on <15% of the meadow, which impact to soil quality. Channel incision has lowered the water table and caused drying of portions of the meadow. Lodgepole encroachment and channel instability are long-term effects caused in part from the channel incision, which may be a result of historic overgrazing. Other evidence of historic grazing effects includes a shift from late seral to early and mid seral plant species. Evidence of current grazing including plant utilization, hoof punching, trailing through the meadow, and streambank chiseling was observed where pack stock have traveled through wet areas. The PFC rating was "functional at risk" (FAR) with an unknown trend due to difficult to interpret trend

indicators. The meadow condition does not meet RCOs. Grazing would not be authorized in this meadow under any of the alternatives.

South Lake Meadow is small (approx. 2 acres), very wet in places, has several channels, and is immediately adjacent to South Lake. No soil compaction, sod fragmentation, of hydrologic alteration was observed. Stream channels in the meadow were visually estimated PFC. The meadow condition meets RCOs. Grazing would not be authorized in this meadow under any of the alternatives.

SE 1st Dinkey Lake Meadow is a 26 acre wet to moist meadow adjacent to 1st Dinkey Lake. Evidence of historic grazing impacts included channel downcutting, hummocks, and vegetation dominated by early seral species. The soil was too wet to assess compaction, but sod fragmentation was present on <15% of the meadow. The meadow condition is a minor departure from meeting RCOs due to hydrologic alteration and vegetation changes. Grazing would not be authorized in this meadow under any of the alternatives.

This AU is located in the Upper Dinkey HUC6, which was identified as over its threshold of concern by the Baseline CWE Assessment (see Table 3.CWE, and the CWE Report, in the project file).

Environmental Consequences

Alternative 1

Direct Effect and Indirect Effects

Soil Quality: No facilities or commercial stock camps are located in this AU and only incidental commercial grazing has been permitted in the past, so discontinuation of trail use by pack stations would be the main cause of effects under this alternative. Commercial pack stock would not cause erosion on trails. Clients would also not use trails or campsites.

Water Quality: There would be no sedimentation or fecal coliform produced by commercial pack stock under this alternative. There would also be no impacts in meadows to soil quality, sedimentation, water quality, geomorphology, or hydrologic function.

Hydrology and Geomorphology: Because there has been no recent commercial pack stock grazing in DIL, and there are no known impacts on these elements that are attributable to recent commercial pack stock use, removing the animals would have no effect on hydrology or geomorphology.

RCOs: Because no recent commercial pack stock grazing has contributed to the minor departure of SE 1st Dinkey Lake Meadow, or to Miner Camp Meadow not meeting RCOs, there would be no change in RCO attainment.

Cumulative Effects
In the Upper Dinkey HUC, the disturbances that contribute to the risk of CWEs include meadow disturbance (31 ac), campsites (15 ac) and trails (5 ac). Because commercial pack station operations are not permitted to graze in meadows or to camp in this AU, their potential contribution occurs on the 5 acres of trails. Impacts on the Dinkey Creek, Mystery Lake, and other trails may be slightly reduced by the removal of commercial pack stock, but such heavy use would remain from private stock and hikers that sedimentation and impacts to meadows would persist at the same level as currently occurs.

The Trail Class of the Mystery Lake Trail would remain TC2, which, given the condition of the trail and the level of use, is not adequate for protecting water quality and meadow hydrologic function. Cumulative fecal coliform would decrease, but private pack stock, wildlife, recreationists, and potentially cattle would continue to contribute.

No commercial pack stock grazing would occur, but meadow condition would probably remain about the same as the existing condition since commercial pack stock have only had incidental grazing in these meadows in the past. No improvement in soil quality or decrease in sedimentation is expected as a result of this alternative.

Alternative 2

Direct, Indirect, and Cumulative Effects
Soil Quality: Pack stock use would occur on system trails and permitted use trails (DIL02 and DIL03), and would contribute to trail erosion. Effects on DIL01 and DIL04, which are prohibited in this Alternative, would be the same as under Alternative 1.

Clients could utilize any legal campsite, but stock would not remain overnight in this AU. This would contribute to impacts to soil quality, but would probably be indistinguishable from the impacts that occur due to heavy recreation use in the AU.

Water Quality: Increasing the Trail Class of the Mystery Lake Trail to TC3 would probably reduce sedimentation.

The Island Lake Trail (27E30) would have its Trail Class increased from TC1 to TC2. This would provide more maintenance. Because this trail was not assessed by the IDT, it is unclear whether this would benefit water quality or meadow hydrologic function.

Hydrology and Geomorphology: Increasing the Trail Class of the Mystery Lake Trail to TC3 would probably reduce impacts to meadows compared to the existing condition, even with the authorization of commercial pack stock use.

The meadows in this AU were determined to be unsuitable for grazing by pack stock, and none would be authorized under this alternative. Meadow condition would probably remain about the same as the existing condition since commercial pack stock have only had incidental grazing in these meadows in the past.

RCOs: Because commercial pack stock grazing would continue to be prohibited in DIL, there would be no change in RCO attainment.

CWEs: DIL contains at least a portion of 2 subwatersheds in the Upper Dinkey HUC6 watershed. As shown in Table 3.29, most of the disturbance in this HUC occurs in meadows (an estimated 31 ac), with disturbance from campsites (15 ac) and trails (5 ac) trailing behind. This alternative authorizes no grazing in this AU. The contribution of pack stock to sedimentation resulting from use of system trails would continue, but the incremental contribution is small. Given the reasons that CWE are occurring, this alternative would not result in increased CWE.

The Upper Dinkey watershed also contains DFC, as well as roads, OHV routes, recent vegetation management projects, active cattle grazing allotments, recreation residences, organizational camps, developed campgrounds, private property, and 3450 acres of foreseeable vegetation management associated with the Kings River Project. Runoff from DIL flows through DFC. However, the cumulative effects of the roads, vegetation management activities, cattle grazing, developed areas, and recreation that occurs in this watershed far outweighs the contribution of the pack station operations. Continued commercial pack stock use in this AU would not affect the risk of a Cumulative Watershed Effects (CWE) response.

Alternative 3

Direct, Indirect, and Cumulative Effects

Soil Quality: Same as Alternative 2, except that no use trails would be authorized and destination zones at Island Lake, 2nd Dinkey Lake, and South Lake would enable site-specific management of impacts to soils and water. These destinations would be for dropping off clients only: as in Alternative 2, there would be no stock overnighting areas in DIL. There would be a reduced risk of long-term impacts to soil quality from camping at specific sites within destination zones.

Outside of these areas, where commercial operators would not be permitted to drop clients, there could be a reduction in impacts related to camping (i.e., campsite size may decrease in some locations, in which case ground cover would increase, soil compaction would decrease and soil quality would improve).

Water Quality: Same as Alternative 2, except that campsites would be designated that meet BMPs and that best protect soils and water bodies from impacts. There would be no increases in sedimentation or fecal coliform resulting from these camps.

There would be a reduced risk of long-term impacts to sedimentation from camping within destination zones, because monitoring would identify impacts and management would be adapted.

The Island Lake Trail (27E30) would remain at TC1 under this alternative. Island Lake is an established destination zone with 2 assigned trips, and a total of 10 unassigned trips that could go there. This trail was not assessed so information is not available to

determine whether TC1 would provide adequate protection of water quality and meadow hydrologic function.

Hydrology and Geomorphology, RCOs, and CWEs: Same as under Alternative 2.

HELMS (HEL)

Affected Environment

No facilities, use trails, or grazing areas are located in this wilderness AU. The Dinkey Lakes Trail Management Plan applies to this AU.

There is currently only light, occasional commercial pack station use. The Helms Meadow Trail (27E56) and the Frazier Trail (27E33) are the most often used. Total use by all recreationists is moderate on the Helms Meadow Trail, which is currently classified as TC1, and heavy on the Frazier Trail, which was accidentally omitted from the Trail Management Plan in the 2001 Wilderness Plan and is unclassified.

The IDT did not assess trails in this AU, so site-specific information about the existing condition of trails in this AU is lacking. The risk associated with this data gap is probably low due to the relatively low use on 3.5 acres of trails in this AU. The Trails section notes that most of these trails receive little use and that some system trails are naturalizing.

Environmental Consequences

Alternative 1

Direct Effect and Indirect Effects

Soil Quality: Removal of commercial pack station use would have very little effect on erosion in this AU, because the existing pack station use is infrequent. The Helms Meadow (27E56) and Nelson Lake (27E09) Trails would remain at TC1 designation, which may not provide enough maintenance to support the moderate use that they receive without some trail degradation.

Water Quality: Removal of commercial pack station use would have very little effect on sedimentation in this AU, because the existing pack station use is infrequent. Removal of the manure produced by this infrequent use would slightly reduce fecal coliform.

Trail degradation on the Helms Meadow and Nelson Lake Trails, if it occurs, could increase sedimentation in Helms Creek because it parallels the Helms Meadow Trail for almost its entire length.

Hydrology and Geomorphology, and RCOs: Because there are no grazing areas in this AU, and no meadows that are affected by other pack station uses, these analysis elements do not have site-specific application within this AU.

Cumulative Effects

Removing pack station use in this AU would have no discernable effect on erosion or sedimentation from trails in this AU because the use has been infrequent. Continuation of

the TC1 trail designation for the Helms Lake Trail (27E56) could result in a net increase in erosion and impacts to water quality in Helms Creek. Erosion from the Frazier Trail (27E09) would enter Courtright Reservoir, which would prevent impacts from being propagated downstream.

Alternative 2

Direct, Indirect, and Cumulative Effects

Soil Quality: This alternative would authorize continued infrequent pack station use in this AU, which is not intense enough to increase the erosion resulting from trails.

Upgrading the Helms Meadow (27E56) and Nelson Lake (27E09) Trails to TC2 would mean that they are more likely to be adequately maintained, which would minimize the impacts of all trail users on erosion.

Water Quality: Sedimentation resulting from trails would be the same as under Alternative 1, due to the infrequent use that would occur.

Upgrading the Helms Meadow and Nelson Lake Trails to TC2 would mean that they are more likely to be adequately maintained, which could reduce the impacts of all trail users on sedimentation.

Hydrology and Geomorphology and RCOs: Because there are no grazing areas in this AU, and no meadows that are affected by other pack station uses, these analysis elements do not have site-specific application within this AU.

CWEs: HEL contains at least a portion of 16 subwatersheds in three HUC6 watersheds. Most of the AU lies in the Upper North Fork Kings HUC6, which also contains NEL. As shown in Table 3.29, disturbance in this HUC is only 0.1% of the area within the wilderness. The Detailed CWE Analysis concluded that CWEs are not occurring in this watershed. This alternative authorizes no grazing in this AU. The contribution of pack stock to sedimentation resulting from use of system trails would continue, but the incremental contribution is small. Runoff from HEL flows into Courtright, and runoff from NEL flows into Courtright without converging – therefore, effects from activities in the two AUs cannot accumulate until the reservoir. The reservoir acts as a buffer for sediment and fecal coliform that are delivered to it, and no upstream effects are propagated downstream of the dam. However, even upstream of Courtright Reservoir, there are no apparent cumulative effects in this AU.

Alternative 3

Direct, Indirect, and Cumulative Effects

Because there are no destination zones in HEL, the only differences between Alternative 2 and Alternative 3 would result from differences in the Dinkey Lakes Trail Management Plan.

Soil Quality: Same as Alternative 2.

Water Quality: Same as Alternative 2, except that two trails, Nelson Lake (27E09) and Bullfrog Lake (27E32) would remain classified as TC1 rather than being upgraded to TC2 trails as in Alternative 2. These trails have not been assessed, so it is unclear whether TC1 is adequate for protecting water quality. The Helms Meadow Trail would be classified TC2 under this alternative (as in Alternative 2), which could reduce sedimentation and riparian impacts in and along Helms Creek.

Hydrology and Geomorphology, RCOs, and CWEs: Because there are no grazing areas in this AU, and no meadows that are affected by other pack station uses, these analysis elements do not have site-specific application within this AU.

Hydrology and Geomorphology, RCOs, and CWEs: Same as under Alternative 2.

NELSON (NEL)

Affected Environment

No facilities are located in this wilderness AU, but the 2.1 acre CPO Cliff Lake Trailhead Spike Station is just outside of the AU and is described in this section. The Dinkey Lakes Trail Management Plan applies in this AU.

CPO is the only commercial pack station that uses this AU, for spot and dunnage and full-service trips to the Cliff Lake and Nelson Lake areas trips. They use the Cliff Lake Trailhead (27E07). Three use trails, which are characterized as stable with few risk factors in the Trails section, are used by CPO for access to campsites and grazing areas.

The CPO Cliff Lake Trailhead Spike Station was assessed. No concerns for soils, water quality or hydrology were identified. The facility meets BMPs.

Two trails were reviewed for impacts to soils and hydrology: the Dinkey Lakes Trail (27E07) and Nelson Lake Trail (27E09). The Nelson Lake Trail was rated '1'. The Nelson Lake Trail is currently classified TC1, which means that it is infrequently maintained. This may be a contributing factor to any localized erosion and meadow impacts that occur. The Dinkey Lakes Trail in this AU was rated '2', though it is stable in most locations. Localized erosion due to steep slopes in the area of Cliff Lake and trail damage to meadows were noted during field assessments.

Four campsites were assessed for BMP implementation and effectiveness. Of these four sites, one (25%) was located too close to water. Evidence of sediment reaching Cliff Lake was found at this site, however the degree of erosion and sedimentation was described as minor. As explained in the Methodology section: these sites were not randomly selected and therefore cannot be interpreted as representing unsampled sites; and may not have been used by commercial operators or their clients and therefore cannot be interpreted as an impact of pack station use.

One meadow was assessed for grazing suitability in NEL. Little Lake Meadow is a small, 2 acre meadow adjacent to Little Lake. There are no streams within the meadow. No soil

compaction, sod fragmentation, or hydrologic alteration was observed, and there was no evidence of historic impacts. Riparian vegetation had low to moderate productivity and low resiliency. The meadow condition meets RCOs. Given the proximity of the grazing area to Little Lake there is a high potential for water quality contamination if used for pack stock grazing. Grazing is not authorized in this meadow under any alternative.

Environmental Consequences

Alternative 1

Direct Effect and Indirect Effects

Soil Quality: Discontinuing use of the CPO Cliff Lake Trailhead Spike Station would result in recovery of 2.1 acres of soils and decrease of any runoff and erosion from this site.

Removing commercial pack stock from trails in this AU would slightly reduce the potential for erosion on the Dinkey Lakes and Nelson Lake Trails.

Little Lake Meadow would not be grazed, which would not result in improvement of soil quality because there are currently no impacts to soil quality, sedimentation, or hydrologic function.

Water Quality: There would be no change in sedimentation and fecal coliform in streams at the CPO Cliff Lake Spike Station, because the site currently meets BMPs and has no impacts to water quality.

Because the trails were rated '1' overall, the extent of the problem areas where some reduction in erosion and sedimentation may occur is limited.

The amount of manure deposited in the AU would decrease, and fecal coliform would also decrease.

Lack of grazing in Little Lake Meadow would not have an effect on water quality, because there are no existing water quality impacts caused within this meadow.

Hydrology and Geomorphology: Little Lake Meadow would not be grazed, which would not result in improvement of hydrologic function because there is no impairment of hydrologic function in this meadow.

Localized impacts of trails on meadow soil quality and hydrologic function would persist, because they are caused by trails that would continue to exist.

RCOs: Trail alignment would still result in impacts to meadows where they occur.

Little Lake Meadow would continue to meet RCOs, because no activity would occur in this meadow.

Cumulative Effects
Ongoing use by other recreationists would result in stream sedimentation that may be slightly less than currently occurs, but the decrease would not be discernable because of the amount of traffic that would continue on the trails. Cumulative sedimentation would be the same as in the existing condition. Because non-commercial recreation use is heavy in this area, and because the trails are relatively stable, removing commercial pack station use would not change the erosion on trails or their sedimentation contribution to CWEs. The Frazier Trail is not included on the existing trail plan, and the lack of maintenance that would result is likely to lead to increased trail erosion. Erosion from the Frazier Trail would enter Courtright Reservoir, which would prevent impacts from being propagated downstream.

Little Lake Meadow would not be grazed by commercial pack stock. It is also not grazed by cattle because the Helms allotment is closed. However, because it has unimpacted soil quality and hydrologic function and it meets RCOs, its condition would not improve.

Alternative 2

Direct, Indirect, and Cumulative Effects
Soil Quality: Trail maintenance levels would be upgraded on several trails, including the Nelson Lake Trail (from TC1 to TC2) and the Frazier Trail (from unclassified to TC1), which would be used by the commercial pack station. These changes to the Trail Maintenance Plan could result in decreased erosion on the segments identified in the field assessments as having erosion problems.

Little Lake Meadow would not be permitted for grazing, so it would continue to have no impacts to soil quality or hydrologic function, and would continue to meet RCOs.

Water Quality: Continued use of the CPO Cliff Lake Trailhead Spike Station would not have an effect to water quality, because the site meets BMPs and has no observed erosion, sedimentation, or impacts to fecal coliform in surface water.

The trails that were assessed in this AU had limited sedimentation issues. This alternative is not expected to increase the impacts associated with trails. Slightly more sediment would be produced than under the No Action Alternative.

Trail maintenance levels would be upgraded on several trails, including the Nelson Lake Trail (from TC1 to TC2) and the Frazier Trail (from unclassified to TC1), which would be used by the commercial pack station. These changes to the Trail Maintenance Plan could result in decreased erosion on the segments identified in the field assessments as having problems, and the net result may be less erosion and fewer impacts to meadows due to trail condition than would occur as a result of removing the commercial pack stock without changing Trail Classes, as under Alternative 1.

Hydrology and Geomorphology: The trails that were assessed in this AU had limited impacts to meadow soil quality and hydrology. The existing impacts would continue under this alternative. Impacts to meadows that result from trail location would continue

until these segments are reconstructed or re-aligned, but about the same levels of impacts would occur as under Alternative 1.

Little Lake Meadow would not be permitted for grazing, so it would continue to have no impacts to hydrologic function.

RCOs: Little Lake Meadow would continue to meet RCOs, because no activity would occur in this meadow.

CWEs: NEL contains at least a portion of 10 subwatersheds in the Upper North Fork Kings HUC6 watershed. This watershed also contains HEL. As shown in Table 3.32, disturbance in this HUC is only 0.1% of the area within the wilderness. The Detailed CWE Analysis concluded that CWEs are not occurring in this watershed. This alternative authorizes no grazing in this AU. The contribution of pack stock to sedimentation resulting from use of system trails would continue, but the incremental contribution is small. Runoff from this AU and HEL enter Courtright without converging – therefore, effects from activities in the two AUs cannot accumulate until the reservoir. The reservoir acts as a buffer for sediment and fecal coliform that are delivered to it, and no upstream effects are propagated downstream of the dam. However, even upstream of Courtright Reservoir, there are no apparent cumulative effects in this AU.

Alternative 3

Direct, Indirect, and Cumulative Effects

Soil Quality: The effects would the same as Alternative 2, except that destination zones at Cliff Lake and Nelson Lake would enable site-specific management of impacts to soils and water. The impacts of commercial customers would be more controlled. Stock overnighting areas would be explicitly specified, and therefore the impacts of that use would be more controlled.

There would be a reduced risk of long-term impacts to soil quality and of sedimentation resulting from camping at specific sites within destination zones, where management would be easily adapted to minimize impacts and ensure compliance with Standards and Guidelines, including RCOs. Outside of these areas, where commercial operators would not be permitted to camp or to drop clients, there could be a reduction in impacts related to camping (i.e., campsite size may decrease in some locations, in which case ground cover would increase, soil compaction would decrease and soil quality would improve).

Water Quality: Campsites would be designated that meet BMPs and that best protect soils and water bodies from impacts.

Hydrology and Geomorphology, RCOs, and CWEs: Same as under Alternative 2.

DINKEY FRONT COUNTRY (DFC)

Affected Environment

The CPO Dinkey Creek Site is used for day rides. A seasonal stream flows immediately adjacent to the northern edge of the facility. Some sediment may be reaching the stream, but not in large amounts due to dense riparian vegetation. No other watershed or water quality concerns were noted, including the permitted fuel storage area.

CPO is the only commercial pack station that operates in this AU. They regularly use the Dinkey Creek Trail and several use trails. The Dinkey Creek Trail is also heavily used by hikers and anglers. The use trails generally receive little use besides CPO. Two use trail loops (6 segments) were reviewed. These trails originate at the CPO Dinkey spike station and are used for day rides. The Forked Meadow trail appears to be lightly used by pack stock and hikers accessing Dinkey Creek below the recreation area. These segments were in good condition, with an overall trail rating of '1'. The Glen Meadow or Sawmill Trail (DFC01) was rated a 3 due to erosion and sedimentation at stream crossings. However, it appeared that trail damage may also be a result of OHV and day hiker use.

No campsites were reviewed for BMP compliance because commercial packers have not camped in this AU.

Two meadows were assessed for grazing suitability within DFC. Mill Meadow is a highly productive 1 acre meadow that is fenced. Soil compaction and sod fragmentation affects <15% of the meadow, and evidence of hydrologic alteration was noted. Existing impacts include hoof punching in the wetter areas and two headcuts, one actively eroding and the other stabilized with vegetation. Several springs were present on the western edge of the meadow. Although a visual assessment (not following the protocol) estimated that the stream channel is PFC, the meadow condition probably does not meet RCOs because of compaction, channel instability, and hydrologic alteration.

Glen Meadow is approximately 18 acres in size and of varying degrees of wetness. At least two portions of the meadow are likely fens, while other parts are moist to dry. A stream flows through a portion of the meadow, but the reach was too short to conduct a PFC assessment. Soil compaction occurs on less than 5% of the meadow, found primarily on the meadow fringes, and sod fragmentation was noted on <15% of the meadow. Impacts observed include severe streambank trampling along a short stretch of stream and general hoof punching throughout meadow and in fens. While the meadow did not appear to have been grazed by pack stock in recent years, it is currently utilized by cattle. Historic impacts observed suggest that past grazing damage has mostly recovered, including evidence of re-vegetated headcuts. Evidence of past logging activity, including compacted landings, was also noted. The meadow does not meet RCOs due to trampling of fens and stream instability that indicates that the stream may not rate as PFC.

Environmental Consequences

Alternative 1

Direct Effect and Indirect Effects

Soil Quality: Discontinuing use of the CPO Dinkey Pack Station facility would allow 5.7 acres of soils to eventually recover. Soil erosion on this site would also decrease.

Removal of commercial stock from the Dinkey Creek Trail would not reduce erosion since the trail is already stable with the mixed use it receives. Use trails would stabilize unless other uses prevent their recovery.

Removal of pack stock grazing from Mill and Glen Meadows would result in improved soil quality in those areas (19 ac).

Water Quality: Because the station has only a minor departure from meeting BMPs and appears to have only a slight effect on water quality by potentially contributing a small amount of sediment to a stream, there is expected to be only a slight benefit to water quality from removing the station.

Most trails are not sediment sources, so the difference in sedimentation would be very slight. Erosion and sedimentation impacts caused by day ride use of the Glen Meadow / Sawmill non-system trail would be eliminated, but the improvement in water quality is expected to be slight because other users of this trail, including hikers and OHVs, would continue.

Impacts to fecal coliform caused by pack stock on trails and by grazing at Mill and Glen Meadows would cease.

Hydrology and Geomorphology: Pack stock impacts to Mill and Glen meadows would not occur, so there would be no potential for their impacts to affect hydrology or geomorphology in these meadows.

RCOs: Mill and Glen Meadows would continue to not meet RCOs, because the reasons they do not meet them are not due to pack station uses, and removal of pack stock would not affect the conditions that do not meet RCOs.

Cumulative Effects

Because most trails used by commercial pack stock are currently stable and the only identified sediment sources would be maintained by other users, removing commercial pack stock use would not significantly reduce sedimentation.

In Glen Meadow, there would be slightly less soil compaction, sod fragmentation, streambank trampling, trampling of the fen, and deposition of manure, however all of these impacts would continue due to commercial cattle grazing. These impacts would be addressed through administration of the cattle grazing permit to improve consistency with RCOs. Mill Meadow may or may not be grazed by cattle if the no action alternative were

chosen. If not grazed, there would be accelerated recovery of impacts caused by historic and recent grazing.

Alternative 2

Direct, Indirect, and Cumulative Effects

Soil Quality: The soils affected by the facility would remain compacted (5.7 acres).

Impacts to soil quality in Glen and Mill Meadows would occur as a result of pack stock grazing. Some soil compaction, sod fragmentation, streambank disturbance, and erosion would result.

The trails that were assessed were not noted to have erosion impacts, other than DFC01, which would continue to erode.

Grazing would continue to result in slight to moderate impacts, however the design measures including range readiness standards and fencing of sensitive areas would minimize soil and stream channel impacts.

Water Quality: If erosion at the CPO Dinkey Creek Site produces observable sedimentation into the stream, BMP 2-28, Surface Erosion Control at Facility Sites, would be implemented through application of erosion control measures.

Use trail DFC01 would continue to erode and increase sedimentation in Glen Meadow Creek. Although sedimentation can be observed at and immediately downstream of the crossing, it is not affecting downstream beneficial uses in the creek.

Hydrology and Geomorphology: Approximately 2 miles of stream channel in Mill and Glen Meadows would be subject to bank trampling by pack stock. Soil disturbance in these meadows could affect hydrology. However, grazing management, including on-dates based on range readiness, use allocations, utilization standards, streambank disturbance standards, and protection of wet areas would limit the amount of disturbance and identify areas where changes in management are needed in order to prevent resource damage from exceeding standards and guidelines and prevent impacts to hydrology and geomorphology.

RCOs: This alternative would move towards RCO compliance by fencing off sensitive fen habitat in Glen Meadow. Other elements of RCO compliance would not be affected by pack stock grazing within the standards and guidelines.

CWEs: DFC contains at least a portion of 6 subwatersheds, all in the Upper Dinkey HUC6 watershed. As explained in the Cumulative Effects Overview, the contribution of pack station operations at the subwatershed scale is a maximum of 0.2% ERA, which is at most a contribution of 1/200 of the lower TOC. As the scale of assessment is expanded, the contribution diminishes even more. The watershed also contains roads, OHV routes, recent vegetation management projects, active cattle grazing allotments, recreation residences, organizational camps, developed campgrounds, private property,

active mining claims, and 3450 acres of foreseeable vegetation management associated with the Kings River Project. DIL lies upstream, and runoff from DIL flows through this AU in Dinkey Creek. However, the cumulative effects of the roads, vegetation management activities, cattle grazing, developed areas, and recreation that occurs in this watershed far outweighs the contribution of the pack station operations. Continued commercial pack stock use in this AU would not affect the risk of a Cumulative Watershed Effects (CWE) response.

Alternative 3

Direct, Indirect, and Cumulative Effects

Destination quotas would not apply in DFC, and approved trails would be the same as under Alternative 2, so the effects to soils, water quality and hydrology in this AU are the same as under Alternative 2.

TULE MEADOW (TUL)

Affected Environment

This AU is comprised of the CPO Pole Corral Headquarters, which was reviewed for this analysis. This facility is used to keep horses when not in the wilderness, as a meeting point for the public, and for overnight use. According to CPO, water is drawn from an adjacent creek and tested for water quality. The area was clean and well kept. From a watershed perspective, this site is ideally located on a ridge far away from water, and meets BMPs. No water quality or watershed concerns were noted.

Alternative 1

Direct Effect and Indirect Effects

Soil Quality: Discontinuing use of the CPO Headquarters would allow 5.6 acres of soils to eventually recover. Any soil erosion on this site would decrease.

Water Quality: The effects to sedimentation and fecal coliform in streams would not be detectable because the site currently meets BMPs and has no impacts to water quality.

Hydrology and Geomorphology and RCOs: Because there are no grazing areas in this AU, and no meadows that are affected by other pack station uses, these analysis elements do not have site-specific application within this AU.

Cumulative Effects

Because the direct and indirect effects would be limited to on-site improvement of soil condition, and no off-site impacts were observed, the cumulative effects of this alternative would be limited to soil improvement. There would be no change in cumulative sedimentation, fecal coliform, or hydrology in or downstream of this AU.

Alternative 2

Direct, Indirect, and Cumulative Effects

Soil Quality: Continued use of the CPO Pole Corral Headquarters would maintain compaction on 5.6 acres of soils.

Water Quality: Use of the facility would not impact water quality, because this site meets BMPs and has no observed impacts to water quality. No change in impacts from this facility would occur under this alternative.

Hydrology and Geomorphology and RCOs: Because there are no grazing areas in this AU, and no meadows that are affected by other pack station uses, these analysis elements do not have site-specific application within this AU.

CWEs: TUL is located on the divide between 2 subwatersheds, entirely within one HUC6 watershed. As explained in the Cumulative Effects Overview, the contribution of pack station operations at the subwatershed scale is a maximum of 0.2% ERA, which is at most a contribution of 1/200 of the lower TOC. Because this facility meets BMPs and has no direct or indirect effects to water quality, there is no contribution to CWEs.

Alternative 3

Direct, Indirect, and Cumulative Effects

Management of the TUL AU would be the same as under Alternative 2. The effects would be the same as under Alternative 2.

WISHON (WIS)

Affected Environment

This small AU is comprised of the Wishon spike station facility and two use trails; WIS01 between the CPO spike station and the Rancheria Trailhead, and WIS02 between CPO headquarters and trail 28E07 near Cliff Bridge. WIS01 is also used by Forest Service pack stock for access to and from the Wishon Work Center.

The CPO Woodchuck Trailhead Spike Station surrounds a small isolated seep/moist meadow. Runoff and erosion from the facility could enter the area, but the lack of evidence that this has occurred recently suggests that this would be a response to large events rather than a chronic or annual occurrence. Some signs of trampling disturbance were present in this area. This is a minor departure from BMPs. This isolated feature is not connected to downstream surface waters, so no off-site impacts to water quality are occurring.

Use trail WIS01 was observed by the District Hydrologist in 2006. A watershed concern was noted in one area where the trail captures water and is becoming incised. Some erosion occurs in this area, but fine sediment has already been carried away and an armored gravel and cobble surface is forming that is not as prone to erosion. Much of the trail appears to follow an old road bed, and although there is one short, steep segment that

is loose and rocky, there are no streams nearby, and this portion of the route does not affect water quality.

Environmental Consequences

Alternative 1

Direct Effect and Indirect Effects

Soil Quality: Discontinuing use of the Wishon spike station would allow 3.4 acres of soils to eventually recover. Runoff and soil erosion on this site would decrease. Direct trampling of the moist meadow and delivery of sediment from the spike station would cease, and it would recover quickly from the trampling impacts that were observed.

WIS02 would probably naturalize because there are no users besides CPO. The condition of WIS01 would improve slightly if CPO use was removed. However, the portion of the trail that captures water would continue to do so. Erosion would decrease slightly if CPO stock traffic was removed.

Water Quality: Since the portion of WIS01 where water quality impacts could occur is somewhat armored by erosion resistant gravel and cobbles, and Forest Service stock would continue to use the trail, only a slight reduction in sedimentation would occur.

Hydrology and Geomorphology: There would be no potential for pack stock to impact the small meadow contained in this facility area. No trampling would occur.

RCOs: Discontinuing animal trampling in the meadow would improve RCO consistency.

Cumulative Effects

WIS01 would continue to receive administrative use. Its condition would probably improve only slightly if CPOs use was discontinued. Since only slight impacts to water quality were observed in this AU, the cumulative effects of this alternative would differ little from the existing condition.

Alternative 2

Direct, Indirect, and Cumulative Effects

Soil Quality: Continued use of the CPO Woodchuck Trailhead Spike Station would maintain compaction on 3.4 acres of soils.

Water Quality: The facility would not impact water quality, because this site has no observed impacts to water quality. The only change that would occur under this alternative is that the small meadow would be avoided. No trampling impacts would occur in this feature, and BMP requirements would be met. This area would be monitored to ensure that the specified avoidance is effective at reducing impacts (see the Monitoring Plan in the ROD).

Hydrology and Geomorphology: Increased runoff and sediment from the surrounding facility could enter the moist meadow during storm events. This effect is expected to be slight on a chronic basis and larger on an episodic basis due to more extreme storm

events. Avoiding trampling through the area would decrease impacts relative to the existing condition.

Use trails WIS01 and WIS02 would not be authorized under this alternative. The effects on these trails would be the same as described under Alternative 1.

RCOs: Protecting the small meadow from animal trampling would improve RCO consistency.

CWEs: WIS lies within one subwatershed. As explained in the Cumulative Effects Overview, the contribution of pack station operations at the subwatershed scale is a maximum of 0.2% ERA, which is at most a contribution of 1/200 of the lower TOC. Because this facility would meet BMPs under this alternative and has no direct or indirect effects to water quality, there is no contribution to CWEs.

Alternative 3

Direct, Indirect, and Cumulative Effects

Soil Quality: Same as Alternative 2, except that WIS01 and WIS02 would continue to receive pack stock traffic, and the erosion and sedimentation impacts described in the affected environment would continue.

Authorizing use of WIS02 would prevent it from naturalizing, which would maintain some level of compaction of the soil on the trail. Runoff and erosion from this trail are minimal, and water quality is generally not affected by its use. Authorizing use of WIS01 would add an increment of use and disturbance to that trail, which would remain in use by Forest Service pack stock under any alternative.

Water Quality: Same as Alternative 2, except that WIS01 and WIS02 would continue to receive pack stock traffic, and the sedimentation impacts described in the affected environment would continue.

WIS01 would deliver some eroded material to a stream in one area, but because the segment is becoming armored with erosion-resistant gravel and cobbles, the impact to water quality is slight. Overall, the potential impacts to sedimentation from this trail are minor.

Fecal coliform would be introduced to the streams crossed by these trails, but not in large enough concentrations to affect beneficial uses.

Hydrology and Geomorphology, RCOs and CWEs: Same as Alternative 2.

ANSEL ADAMS/JOHN MUIR (AA/JM)

Affected Environment

A comprehensive discussion of the watershed resource (soils, water quality, and hydrology) for the Ansel Adam/John Muir AU can be found in the 2005 Pack Stock

Management EIS. Soils are located on page III-95 and hydrology is located at page III-112. This EIS incorporates that information by reference.

Environmental Consequences

Water quality is thought to be good and would remain so except at few very local areas where there may be slight degradation. There would remain areas of local soil erosion, bare soil and sedimentation into surface water from pack stock grazing, campsites and trails. There would be a very minor reduction of bare, compacted soil and sedimentation into surface water from designating stock holding camps, reducing the number of meadows where grazing is allowed, and limiting grazing stock nights in all meadows where grazing is allowed. Of 60 streams found to be functional at risk, (151 evaluated) it is estimated that 42% could have improved condition, about 1% could have a more degraded condition; about 57% should remain functional at risk. Meadow hydrologic function has some potential for improvement. Of the 41 meadows found to currently have hydrologic function alteration (230 evaluated), about 22% could have improved condition, 65% should remain in the same condition, and about 13% could have a downward trend.

Past and present grazing from production livestock and pack stock is thought to be the largest contributor to meadow hydrologic function alteration. The prescriptions limit grazing to those meadows that have been analyzed and designated as suitable for grazing. Meadows where streams are rated non-functional or functional at-risk with a downward trend are rested for grazing until conditions improve enough to support use. The two exceptions are Jackson Meadow and Purple Meadow. Jackson Meadow has portions where streams were rated functional at-risk, but those sections would be closed to grazing and the segments with streams at PFC would be grazed. Purple Meadow, where the stream was rated functional at-risk with a downward trend in 2001, showed an upward trend in 2004 and 2005. Therefore, it is determined to be resilient and able to support about 1/3 of the grazing that it experienced in the past. This alternative also limits grazing in those suitable meadows to a given number of stock nights. The restriction of grazing to meadows found to be suitable for grazing and not highly vulnerable to impacts should limit future adverse grazing impacts.

A comprehensive discussion of the environmental consequences to the watershed resource for the Ansel Adam/John Muir AU can be found in the 2005 Pack Stock Management EIS on pages IV-227, 340, 357, 374, 392, 404 and 416. This FEIS incorporates that information by reference.

3.2.2 Air Quality

3.2.2.1 Background

The air quality in the San Joaquin Valley and surrounding Sierra Nevada range (the San Joaquin Valley Air Pollution Control District, or the District) is among the poorest in the state. There are six federal criteria air pollutants for which national ambient air quality standards have been established: carbon monoxide, lead, nitrogen dioxide, ozone,

particulate matter, and sulfur dioxide. Of those, particulate matter (discussed in terms of PM10)[1] is the main pollutant that pack station operations can affect[2]. Major sources of PM10 include vehicle emissions, smoke, industrial emissions, and dust from development, agriculture, native surface roads, and other sources. The District is classified non-attainment for the new finer PM2.5 particulate fraction and a State Implementation Plan is due in April of 2008. However, sources of dust in the AUs are expected to produce PM more in the 10 micron range.

The Valley Air District has set rules to limit fugitive dust emissions. However, activities conducted at elevation of 3,000 feet or higher above sea level are exempt. The lowest elevation where commercial pack station operations occur is 4100 feet (NED). Pack station operations on the Sierra National Forest are therefore exempt from Regulation VIII (Fugitive PM10 Prohibitions) and Rules 8011 General Requirements and 8081 Agriculture Sources.

Levels of airborne particulates (PM10) in the District exceed the federal standard less than five times annually (2 days so far in 2006). However, because the California standard is set at a lower and more protective level, the District exceeds this limit an average of 90-100 days per year (SJVUAPCD 2003) (200 days so far in 2006). The monitoring stations are located in cities and towns in the Central Valley. None are near any of the AUs.

Lands designated as ***Class I Areas*** under the Clean Air Act Amendments of 1977 are afforded the highest level of protection from air pollutants in the nation. These lands consist of national wildernesses (Forest Service), parks (National Park Service) and wildlife refuges (U.S. Fish & Wildlife Service) in existence at the time the amendment was passed. All other lands in the nation are designated as Class II. (http://www.fs.fed.us/r6/aq/natarm/c1info.htm)

Based on the Clean Air Act, 156 areas (mostly wilderness and national park lands) are identified by the Environmental Protection Agency (EPA) as Mandatory Class 1 Airsheds. These areas are afforded the greatest degree of air quality protection. The Kaiser (KAI), Ansel Adams and John Muir Wildernesses (AA/JM) are Class I areas. The Dinkey Lakes (COO, DIL, HEL, NEL AUs) Wilderness is not classified as a Class 1 Airshed.

Class I Areas

The Clean Air Act also gave federal land managers (FLM's) an "affirmative responsibility" to protect the Air Quality Related Values (AQRVs) of Class I areas from adverse air pollution impacts. AQRVs are those features or properties of a Class I area

[1] PM10 is particulate matter that is 10 microns or smaller in diameter. It is of concern because it can be inhaled into the lungs and cause health problems, especially when the particulates include metals or toxic substances.

[2] Operations can also make minor contributions to other pollutants due to the use of vehicles to access their pack station facilities. However, this use is extremely limited when compared to the total amount of motor vehicle use in the Sierra National Forest and in the Valley Air District that it is not analyzed for this project.

which can be changed by air pollution. Mandatory Class I areas were designated under the Clean Air Act and are certain wilderness, national parks or wildlife refuges designated before August 7, 1977. These Class I areas receive the highest degree of regulatory protection from air pollution impacts. Class I areas can be considered "smoke sensitive areas" and impacts from prescribed fire may need to be specifically addressed in alternatives. (Incorporating Air Quality Effects of Wildland Fire Management into Forest Plan Revisions A Desk Guide USDA Forest Service April 2000 DRAFT).

Depending on the soil type, soil moisture, and level of use on a trail, stock walking on trails and in campsites can create dust. Stock use on trails and in campsites can increase airborne dust – PM10 – for a short time (less than 5 minutes) on and directly adjacent to the trail. At the pack stations themselves, most soils are compacted rather than powdered. However, depending on soil type, soil moisture, and stock activity (stock can move around in a corral creating dust at feeding time) local increases in PM10 could result. The relatively small amount and brief time frame of dust generated precludes any public or community health risk.

3.2.2.2 Overview – Common to All

Affected Environment

Currently the Valley Air District is federally classified as attainment for the federal particulate matter less than 10 microns in diameter (PM10) standard. However, the District is classified as non-attainment for California's PM10 standard. Attainment status for PM10 was requested from the EPA on April 25, 2006, www.valleyair.org, 2006. The EPA changed the federal classification for PM10 from severe non-attainment to attainment on October 17, 2006. Mariposa County is unclassified for both Federal and State PM10 attainment status.

Table 3.39: Summary of current attainment classifications PM10 standards.

Air Pollution Control District	Federal PM10 standard	Classification for Federal PM10	California PM10 standard	Classification for California PM10
San Joaquin Valley	50μg/m^3 annual mean	attainment	30μg/m^3 annual mean	Non-attainment
Mariposa	150μg/m^3 24-hr max	unclassified	50μg/m^3 24-hr max	unclassified

Environmental Consequences

Alternative 1

Direct, Indirect, and Cumulative Effects

Air quality impacts from recreational activities in the project area have not been measured, but are estimated to be highly localized and short in duration.

Commercial pack station operations would not contribute to PM10 concentrations anywhere on the Sierra National Forest. Commercial pack stock would not be present so therefore would not powder soils on trails, at campsites, or in corrals at pack station facilities.

On trails and in campsites, other users, including privately owned pack stock as well as hikers, would continue to powder soils and suspend dust, contributing to localized PM10 concentrations. Over time, the pack station facility areas (e.g. corrals) would revegetate and would no longer be a potential dust source. At these local scales, there would be some reductions in PM10 concentrations. For ambient PM10 concentrations as monitored for compliance with federal and California standards, there would be no detectable change under this alternative.

Alternative 2

Direct and Indirect Effects

Depending on soil type, soil moisture, and level of use, commercial pack station operations could create dust that contributes to PM10 concentrations through their use of system trails and roads, use trails, campsites, and corrals within permitted area. The areas affected by this dust would be localized and of short duration (~5 minutes).

In any of these affected areas, wind can suspend the dust, increasing PM10 concentrations. Other recreationists, including hikers, can also stir up loose dust and raise PM10 concentrations, particularly on trail segments that have been powdered by commercial pack stock.

Cumulative Effects

Other actions and conditions that affect PM10 in the Air Pollution Control District containing these AUs include: vehicle emissions both in the Sierra National Forest and in the San Joaquin Valley; smoke from vegetation management actions, wildfires, campfires, and agricultural burning; dust from motorized vehicle use of native surface roads and trails, from vegetation management actions that result in ground disturbance, from privately owned pack stock and cattle; and industrial emissions from the San Joaquin Valley. Authorization of commercial pack stations may contribute a local and small volume of dust and vehicle emissions over a very short time, but they are a negligible portion of the cumulative air quality condition at this scale. Because the direct and indirect effects on air quality are very local and temporary, there would be no additive effects between these and the effects of other activities that do not occur in the same locations.

At the local scale, such as at a heavily used trail segment with powdered soils, effects could accumulate in time. For example, any given pack string on that trail would create a short-term effect, but if several pack strings pass every hour all day, then cumulatively there would be a more constant PM10 impact. This is not expected to occur, given the limited number of trips each pack station is allowed per season. For ambient PM10 concentrations as monitored for compliance with federal and California standards, there would be no detectable change under this alternative.

Alternative 3

Direct, Indirect and Cumulative Effects

The impacts described under Alternative 2 would also occur under Alternative 3.